STATE OF NEW HAMPSHIRE

Technical Support Document for the Great Bay Estuary Aquatic Life Use Support Assessments, 2016 305(b) Report/303(d) List

May 8, 2017

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

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May 8, 2017

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Introduction

The Federal Water Pollution Control Act [PL92-500, commonly called the Clean Water Act (CWA)], as last reauthorized by the Water Quality Act of 1987, requires each state to submit two surface water quality documents to the U.S. Environmental Protection Agency (USEPA) every two years. Section 305(b) of the CWA requires submittal of a report (commonly called the "305(b) Report"), that describes the quality of its surface waters and an analysis of the extent to which all such waters provide for the protection and propagation of a balanced population of shellfish, fish, and wildlife, and allow recreational activities in and on the water. The second document is typically called the "303(d) List," as required by Section 303(d) of the CWA, includes surface waters that are:

1. Impaired or threatened by a pollutant or pollutant(s).
2. Not expected to meet water quality standards within a reasonable time even after application of best available technology standards for point sources or best management practices for nonpoint sources.
3. Require the development and implementation of a comprehensive water quality study (i.e., called a Total Maximum Daily Load or TMDL study) that is designed to meet water quality standards.

In accordance with these requirements, the New Hampshire Department of Environmental Services (NHDES) assesses all available data for lakes, rivers and estuaries every two years to determine compliance with the Surface Water Quality Regulations, Env-Wq 1700 *et sq*. The assessments determine whether or not water quality supports specific designated uses. Designated uses are the desirable uses that surface waters should support such as swimming (i.e., Primary Contact Recreation) and fishing (i.e., Aquatic Life). The full list of designated uses considered by NHDES is:

- Aquatic Life: Waters that provide suitable chemical and physical conditions for supporting a balanced, integrated and adaptive community of aquatic organisms.
- Fish Consumption: Waters that support fish free from contamination at levels that pose a human health risk to consumers.
- Shellfish Consumption: Waters that support a population of shellfish free from toxicants and pathogens that could pose a human health risk to consumers.
- Drinking Water Supply After Adequate Treatment: Waters that after adequate treatment will be suitable for human intake and meet state/federal drinking water regulations.
- Primary Contact Recreation (i.e. swimming): Waters suitable for recreational uses that require or are likely to result in full body contact and/or incidental ingestion of water.
- Secondary Contact Recreation: Waters that support recreational uses that involve minor water contact.
- Wildlife: Waters that provide suitable physical and chemical conditions in the water and the riparian corridor to support wildlife as well as aquatic life.

The Great Bay Estuary constitutes approximately 86 percent (by area) of all New Hampshire estuaries. The Great Bay Estuary is a national treasure and a valuable resource to the state, and, as such, has been designated by USEPA as an "estuary of national significance" under Section 320 of the CWA. The 2013 State of the Estuaries Report for the estuary (PREP, 2013) showed that the Great Bay Estuary has all the classic signs of eutrophication: increasing nitrogen concentrations, low dissolved oxygen and disappearing eelgrass habitat. These symptoms of eutrophication have the potential to impair the Aquatic Life designated use, which would be a violation of the state water quality standards for nutrients (Env-Wq 1703.14) and biological and aquatic community integrity (Env-Wq 1703.19):

Env-Wq 1703.14
(b) Class B waters shall contain no phosphorus or nitrogen in such concentrations that would impair any existing or designated uses, unless naturally occurring.

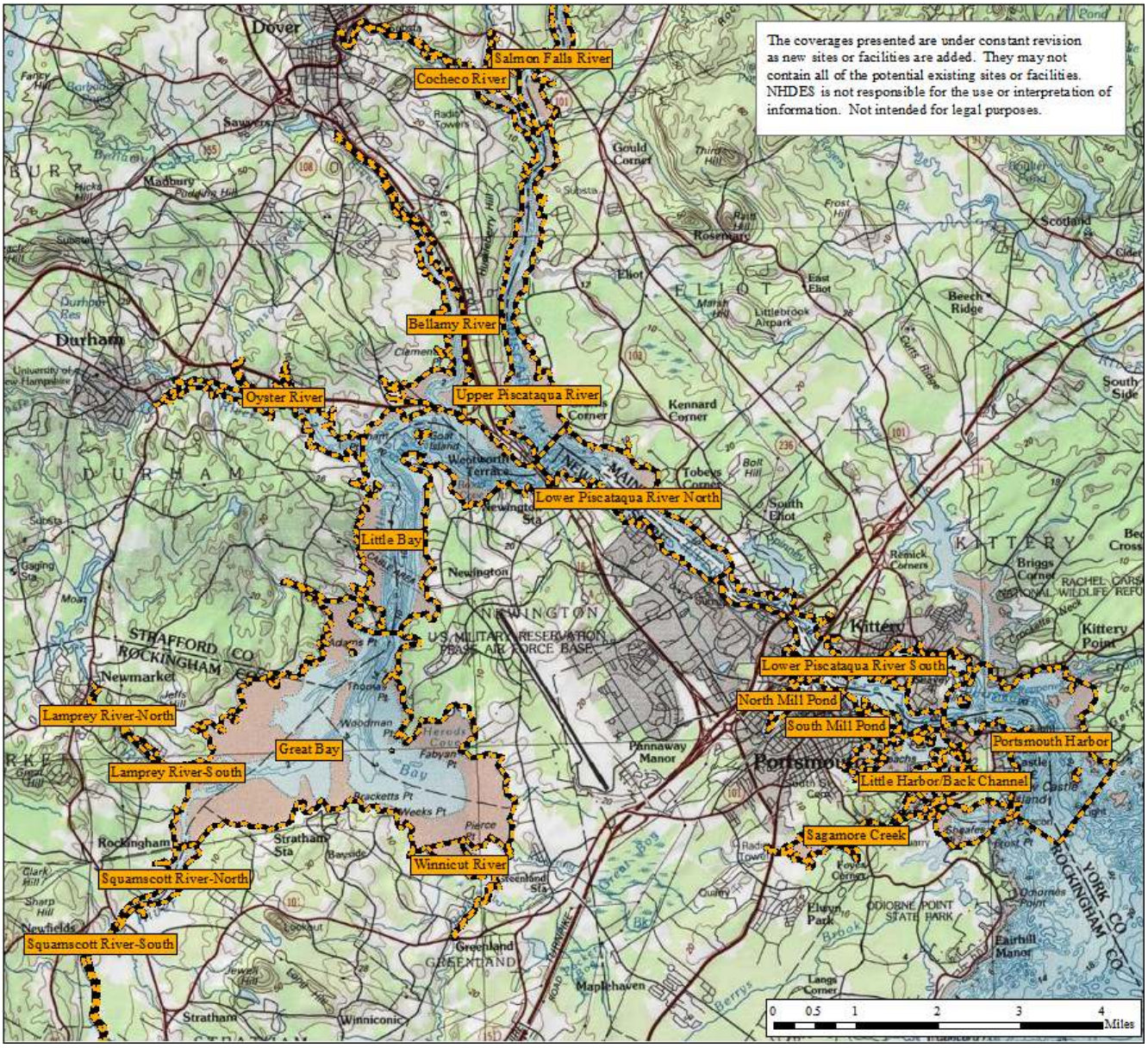
Env-Wq 1703.19
(a) The surface waters shall support and maintain a balanced, integrated, and adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of a region.
(b) Differences from naturally occurring conditions shall be limited to non-detrimental differences in community structure and function.

Given the complexity of the Great Bay Estuary and the inherent challenges in assessing it, this document is meant to provide additional information about how the water quality status of each of the 19 assessment zone was determined. Specifically, this document addresses the water quality data used to determine if the Estuary meets the Aquatic Life designated use.

Estuary Assessment Zones

For 305(b)/303(d) assessments, NHDES uses 43 assessment units to cover the Great Bay estuary that are coincident with the shellfish growing areas established by the NHDES Shellfish Program. Great Bay itself consists of seven different assessment units. Nitrogen and eutrophication parameters are logically evaluated utilizing data from larger aggregates of assessment units covering contiguous areas. Eutrophication effects are less localized than the bacteria pollution sources that affect shellfish harvesting. Therefore, NHDES aggregated the 43 assessment units in the Great Bay Estuary into 19 assessment zones. The boundaries of each of the aggregated assessment zones are shown in Figure 1. For the purposes of 305(b)/303(d) reporting, the categories assigned to these larger assessment zones will be assigned to each of the assessment units within the zone. For the Salmon Falls/Piscataqua River, the assessment zones cover both the New Hampshire and Maine sides of the main stem of the river in order to select data from both sides of the river. The river is well-mixed and data from both sides of the state line are needed to provide a comprehensive dataset for assessments. However, the impairment determinations made by NHDES only apply to the New Hampshire side of the river. The Maine Department of Environmental Protection makes its own impairment determinations for the Maine side of the Salmon Falls/Piscataqua River. No changes have been made to the composition or locations of assessment zones between the 2014 and 2016 reporting cycles reported in this document.

Figure 1. Great Bay Estuary assessment zones for the 2016 305(b)/303(d) aquatic life designated use assessments.



Eelgrass Mapping

In 2013, eelgrass was mapped in the Great Bay Estuary using two different sets of aerial imagery. As has been done since 1996, UNH (Dr. Fred Short) mapped eelgrass using low-altitude, oblique aerial photographs, while in 2013 and 2016, Seth Barker used high resolution vertical aerial imagery collected by Kappa Mapping Inc. Eelgrass extent was independently mapped using both sets of imagery. These concurrent datasets were obtained as a way to evaluate each of the methodologies. For assessment purposes, NHDES took an average of the eelgrass mapped by UNH and Kappa/Barker in the years where both mappers produced datasets.

Water Quality Data

The NHDES Environmental Monitoring Database (EMD) is a publically accessible database containing field observations, measurements and laboratory samples for various public, private and volunteer programs. It was developed in March 2003 and became available on the web in June 2004. Data sets are continuously being added and updated. Datasets from the EMD are the foundation of the water quality assessments. The procedures below describe the processes that were undertaken to compile and synthesis the comprehensive dataset from the EMD for the Aquatic Life designated use assessment of the Great Bay Estuary described in this document.

1. The base dataset that is considered "current" data for the 2016 assessments are the measurements collected on or after January 1, 2011, that were incorporated in the NHDES Environmental Monitoring Database (EMD) by November 21, 2016. For nutrients and most estuarine samples this generally meant data collected through 2015. To enhance the ability to look across cycles and into more historic data the Supplemental Assessment Database (SADB) minimum date age was set to January 1, 1990.
2. The data were pulled from the EMD into the SADB by an automated query. Some of the conditions on the query were:
   a. Results marked as invalid were excluded.
   b. Results marked as Below Detection Limits (BDL) were assigned a value of one-half the Method Detection Limit (MDL). [Note: BDLs: In the nutrient criteria report, NHDES used the MDL for BDLs. In the bulk query, the adjusted value is reported as 1/2 the MDL. PREP has used 1/2 MDL for BDLs for trends in "modern" datasets. Therefore, for the 2016 assessments, NHDES will apply the 1/2 MDL approach for consistency across datasets.]
   c. Quality assurance samples were excluded. This condition removed field duplicate samples. [Note: QA samples: In the nutrient criteria report, NHDES averaged field duplicate results. In the bulk query, field duplicates were excluded. PREP has included replicates in the past but recently the TAC decided to not include QA samples to be consistent across datasets. Therefore, for the 2016 assessments, NHDES will exclude QA replicate samples for consistency.]

Aquatic Life Designated Use Assessment Summary Table

Comparison of the Final 2014 and Final 2016 assessment of eutrophication parameters for the Aquatic Life designated use in the Great Bay assessment zones. Assessment category definitions are provided in section 3.1.3 and 3.1.5 of the 2016 CALM.

De-impairment | New Impairment

Assessment Zone	Cycle	Chlorophyll-a	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Sat)	Estuarine Bioassessments (eelgrass)	Water Clarity (Light Attenuation Coefficient)	Total Nitrogen
Squamscott River South	2014	5-P	5-P	5-M	No Std	No Std	5-P
	2016	5-P	5-P	5-M	No Std	No Std	5-P
Squamscott River North	2014	5-P	5-P	5-M	5-P	5-P	5-P
	2016	5-P	5-P	5-M	5-P	5-P	5-P
Lamprey River North	2014	5-M	5-P	5-P	No Std	No Std	5-M
	2016	5-M	5-P	5-P	No Std	No Std	5-M
Lamprey River South	2014	5-M	2-G	3-PAS	5-P	5-P	5-P
	2016	5-M	2-G	3-ND	5-P	5-P	5-M
Winnicut River	2014	3-ND	2-M	2-M	5-P	3-ND	3-ND
	2016	3-ND	3-ND	3-ND	5-P	3-ND	3-ND
Great Bay	2014	2-M	3-PNS	2-M	5-P	5-M	3-PNS
	2016	3-PNS	3-PNS	2-M	5-P	5-M	3-PNS
Little Bay	2014	2-M	2-G	2-M	5-P	5-M	3-PNS
	2016	3-PNS	2-G	2-G	5-P	5-M	3-PNS
Oyster River	2014	5-M	5-P	5-P	5-P	5-P	5-P
	2016	2-M	5-P	5-P	5-P	5-P	5-PM
Bellamy River	2014	3-PNS	3-PAS	3-ND	5-P	3-PNS	3-PNS
	2016	3-ND	3-ND	3-ND	5-P	3-ND	3-ND
Cocheco River	2014	5-P	3-PNS	2-M	No Std	No Std	3-PNS
	2016	5-P	5-M	2-M	No Std	No Std	5-M
Salmon Falls River	2014	5-P	5-P	5-P	No Std	No Std	5-M
	2016	5-P	5-P	5-M	No Std	No Std	5-M
Upper Piscataqua River	2014	2-M	3-PNS	2-G	5-P	5-P	3-PNS
	2016	2-M	3-PNS	2-G	5-P	5-P	3-PNS
Lower Piscataqua River - North	2014	3-PAS	2-G	2-G	5-P	3-PNS	3-PNS
	2016	3-PAS	2-G	2-G	5-P	3-PNS	3-PAS
Lower Piscataqua River - South	2014	3-PAS	2-G	2-G	5-P	3-PAS	3-PNS
	2016	3-PAS	2-G	2-G	5-P	3-PAS	3-PAS
North Mill Pond	2014	3-ND	2-G	2-G	3-ND	3-ND	3-ND
	2016	3-ND	3-ND	3-ND	3-ND	3-ND	3-ND
South Mill Pond	2014	3-ND	2-G	2-G	3-ND	3-ND	3-ND
	2016	3-ND	3-ND	3-ND	3-PAS	3-ND	3-ND
Portsmouth Harbor	2014	2-G	2-M	2-M	5-P	5-M	3-PNS
	2016	2-G	2-G	2-G	5-P	5-M	2-M
Little Harbor/Back Channel	2014	3-PAS	2-G	3-ND	5-P	5-M	3-PNS
	2016	3-ND	3-ND	3-ND	5-P	5-M	3-ND
Sagamore Creek	2014	3-PAS	3-PAS	3-ND	5-P	3-ND	3-ND
	2016	3-ND	2-M	3-ND	5-P	3-ND	3-ND

Assessment Zone Data Summaries

Plot Legend and Summary Table Abbreviations

In the assessment zone summaries that follow, all available data from January 1, 2000, to November 21, 2016, are displayed in the data plots for context. Summary statistics in the data tables cover the period from January 1, 2011, to November 21, 2016. For nutrients and most estuarine samples this generally meant data collected through 2015. The legend for a given attribute only contains indicator text for those indicators that have data available since the year 2000. The full comparison codes for the samples are predominantly those from the SADB and were used within the legend of the graphs and tables for brevity. The descriptions for those codes are provided below.

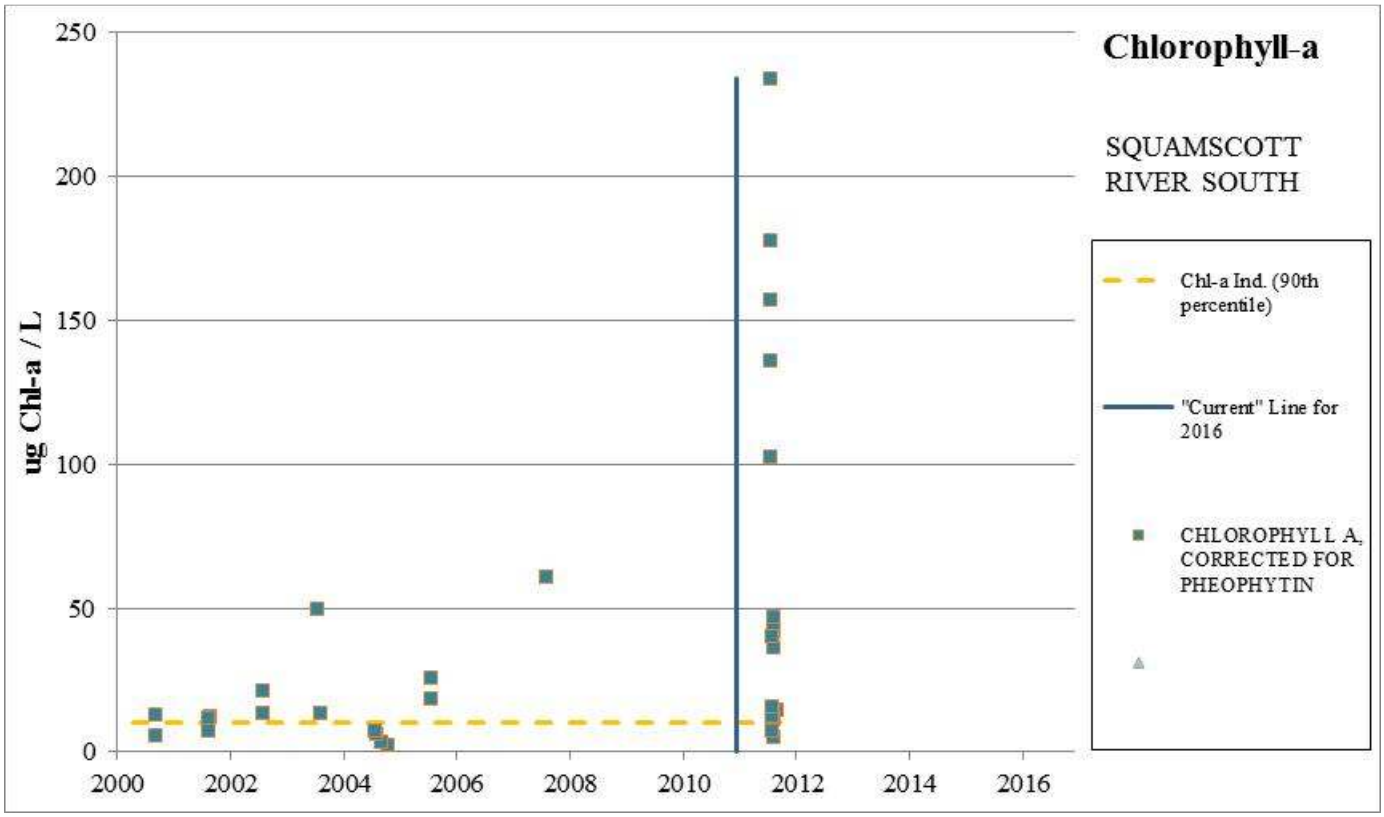
- Chlorophyll-a
    - CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN - The majority of the chlorophyll-a in the marine environment has been processed with the correction for pheophytin.
    - CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN – In a few cases samples the chlorophyll-a in the marine environment has been processed without the correction for pheophytin.
    - CHLOROPHYLL A, combined – In those cases where both corrected and uncorrected chlorophyll-a have been collected, the statistics for the combined measurements are provided.
- Dissolved Oxygen Concentration
    - DO-PPM-24HR-MIN-CP = 24 hour minimum dissolved oxygen concentration from a datalogger deployed during the summer critical period.
    - DO-PPM-24HR-MIN-NCP = 24 hour minimum dissolved oxygen concentration from a datalogger not deployed during the summer critical period.
    - DO-PPM-GRAB-CP = Grab samples of dissolved oxygen concentration during the summer critical period.
    - DO-PPM-GRAB-NCP = Grab samples of dissolved oxygen concentration during the summer critical period.
- Dissolved Oxygen Percent Saturation
    - DO-PERC-24H-MEAN-CP = 24 hour average dissolved oxygen percent saturation from a datalogger deployed during the summer critical period.
    - DO-PERC-24H-MEAN-NCP = 24 hour average dissolved oxygen percent saturation from a datalogger not deployed during the summer critical period.
    - DO-PERC-2TIDE-GRAB-CP = The average to two grab samples for dissolved oxygen percent saturation, one at high tide and one at low tide of a single day, during the summer critical period.
    - DO-PERC-2TIDE-GRAB-NCP = The average to two grab samples for dissolved oxygen percent saturation, one at high tide and one at low tide of a single day, not during the summer critical period.

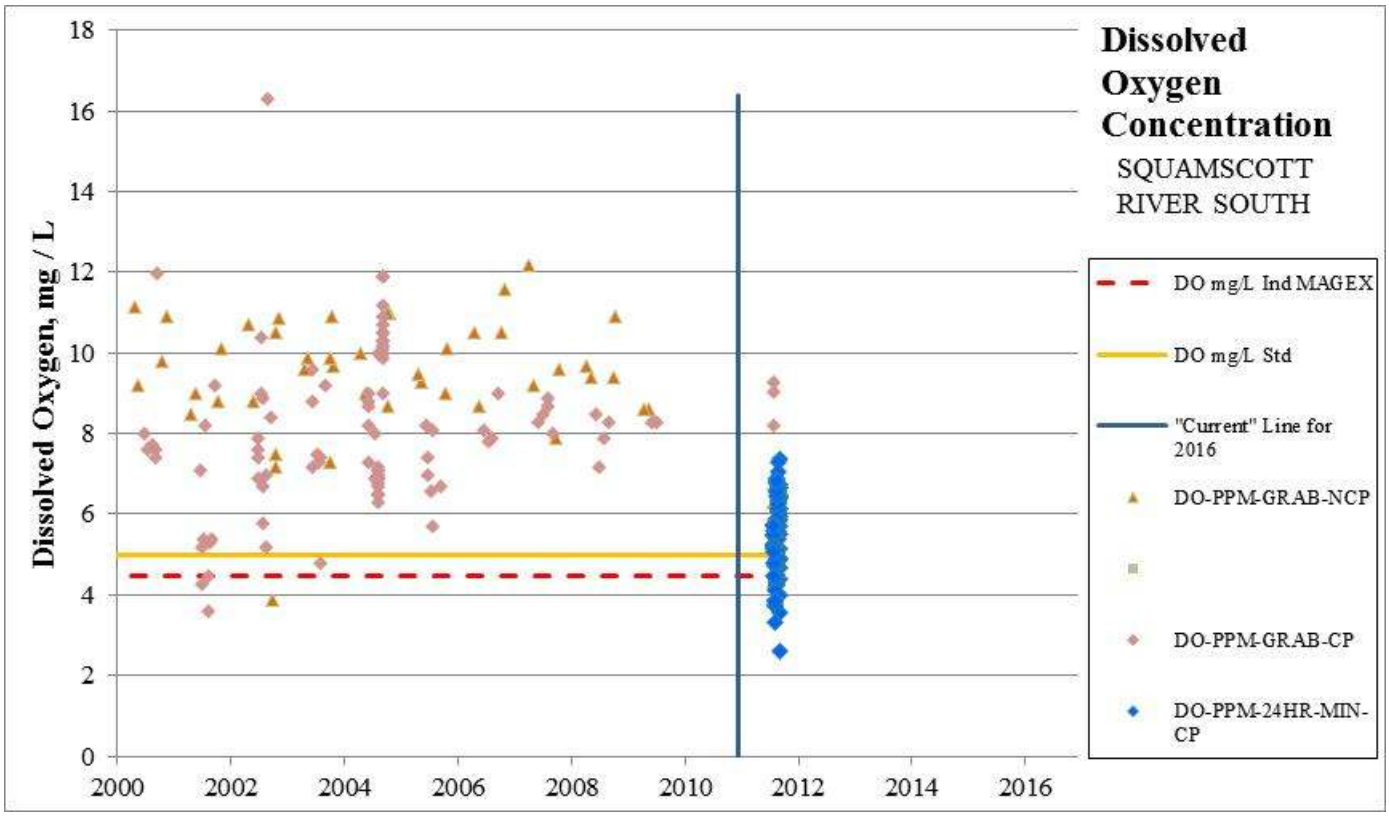
- LIGHT ATTENUATION COEFFICIENT (Water Clarity) – A measurement of the light attenuation coefficient, Kd.
- Nitrogen – Graphics within this document plot the primary indicator of total productivity within the system, total nitrogen (TN) while the tables provide the statistics for TN and individual fractions of nitrogen. In most cases, there was one sample collected at a given station per day. Where multiple samples were collected at a particular station on a single day, those samples for multiple times and/or depths were processed as described in the sections above.
    - Day Ave of TN – Total Nitrogen
    - Day Ave of TDN – Total Dissolved Nitrogen.
    - Day Ave of DIN (NH3 + NO2/3) – Dissolved Inorganic Nitrogen
    - Day Ave of NH3 - Ammonia
    - Day Ave of PON – Particulate Organic Nitrogen
    - Day Ave of NO2/3 – Nitrite/Nitrate
- Plot Reference Lines
    - "Current" Line for 2016 - Per the methodology outlined in the CALM, all data to the right of this referenced data are considered "current." Available older data are provided for context and are needed for that historic context if newer data indicates improved conditions. See the 2016 CALM for addition details.
    - Chl-a Ind. (90^{th} percentile) – This is the reference line for the chlorophyll-a indicator. The 90^{th} percentile (10 ug/L) of the assessment zone dataset is compared to this chlorophyll-a indicator described in the CALM.
    - DO mg/L Std. – This is the 5 mg/L reference line for the dissolved oxygen standard.
    - DO mg/L Ind MAGEX – This is the 4.5 mg/L reference line for the dissolved oxygen magnitude of exceedence indicator described in the CALM.
    - DO % Sat Std. – This is the 24 hour average 75 percent reference line for the dissolved oxygen percent saturation standard.
    - DO % Sat Ind MAGEX – This is the 24 hour average 65 percent reference line for the dissolved oxygen percent saturation magnitude of exceedence indicator described in the CALM.
    - Survival Min. Ind. (median) – This is light attenuation coefficient indicator that corresponds to the minimum light needed for eelgrass to survive at the restoration depth set for a given assessment zone. The median of the assessment zone dataset is compared to this light attenuation coefficient indicator as described in the CALM.
    - TN Gulf of Maine (median) – This is the median total nitrogen in the Gulf of Maine. This reference line is provided as a consistent point of reference across assessment zones.

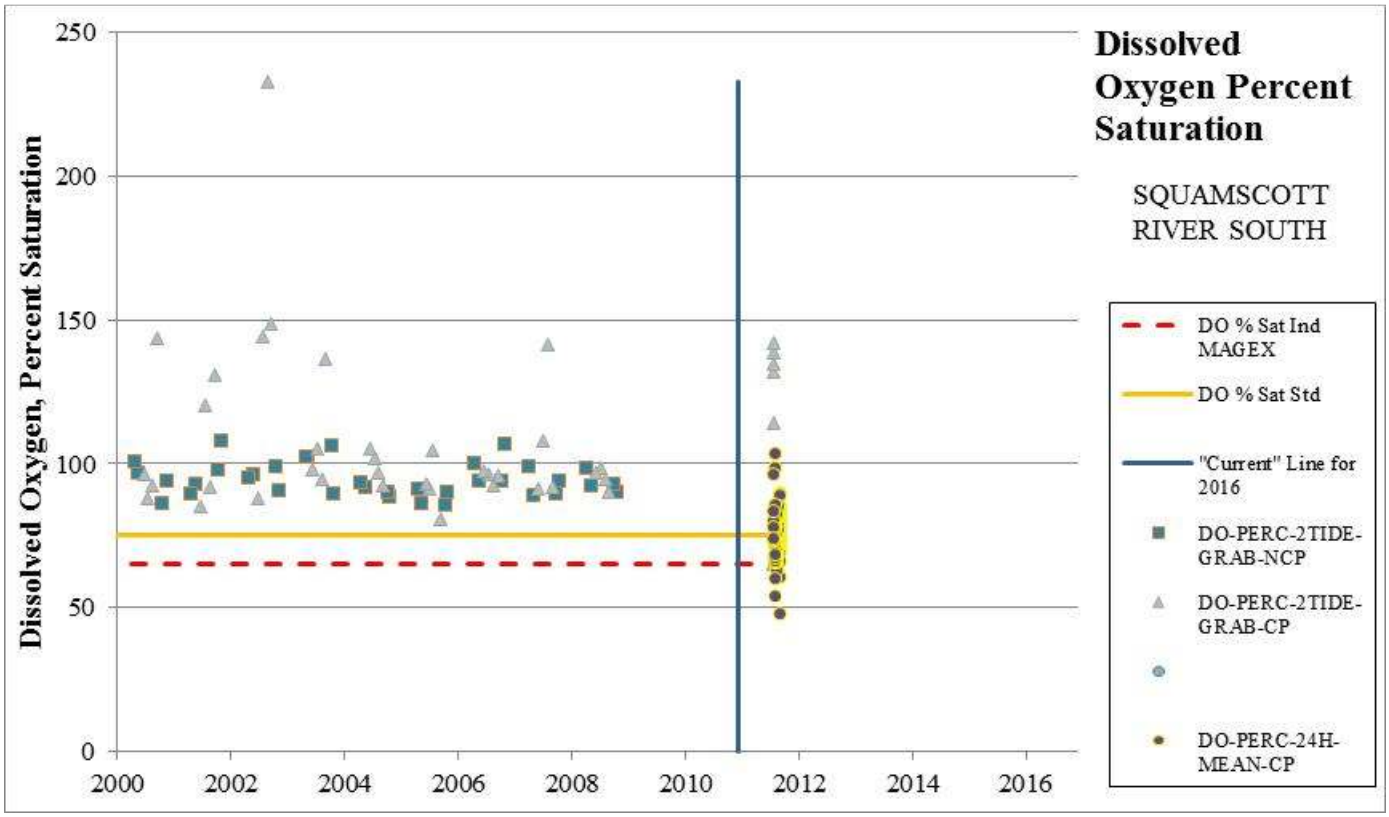
Assessment Zone = SQUAMSCOTT RIVER SOUTH

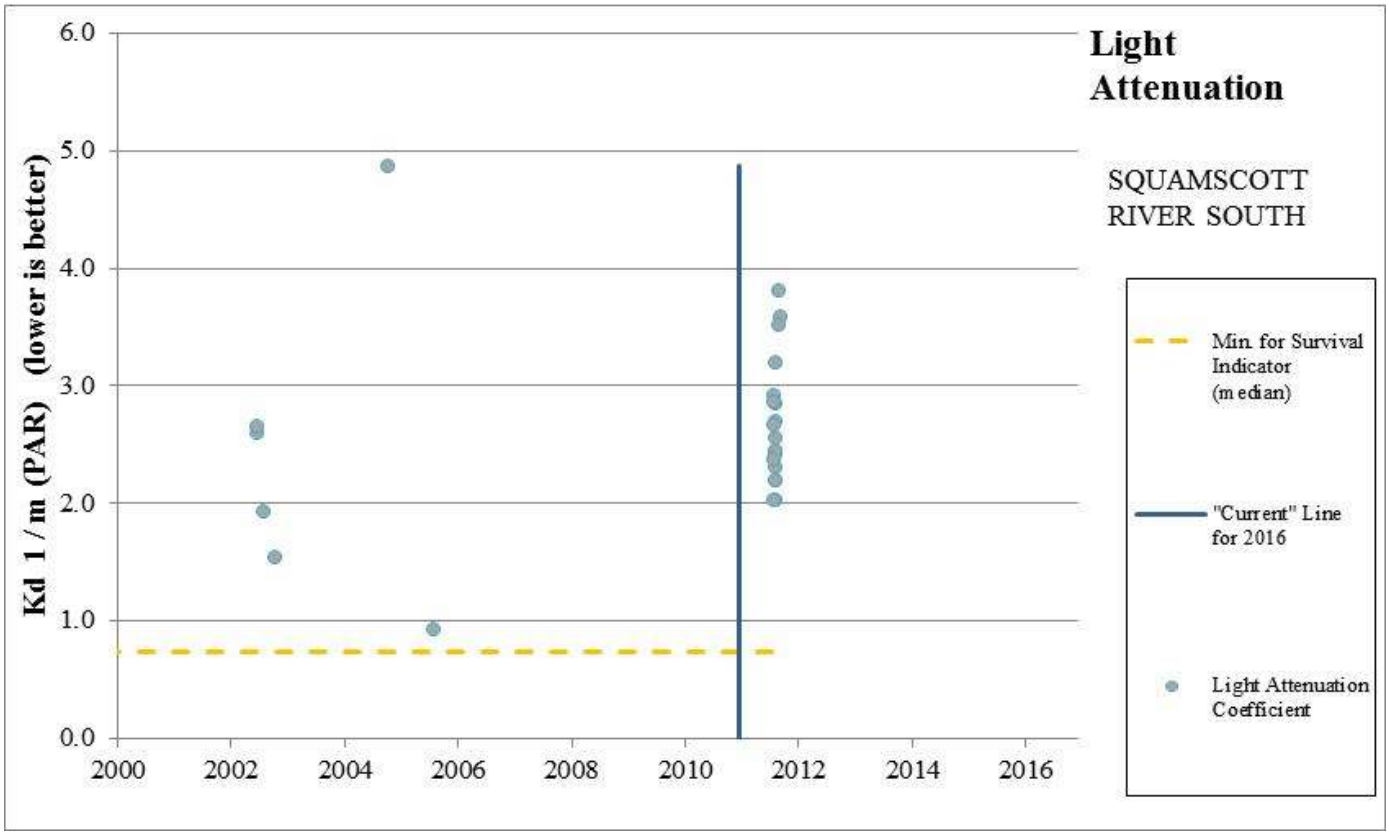
(NHEST600030806-01-01)

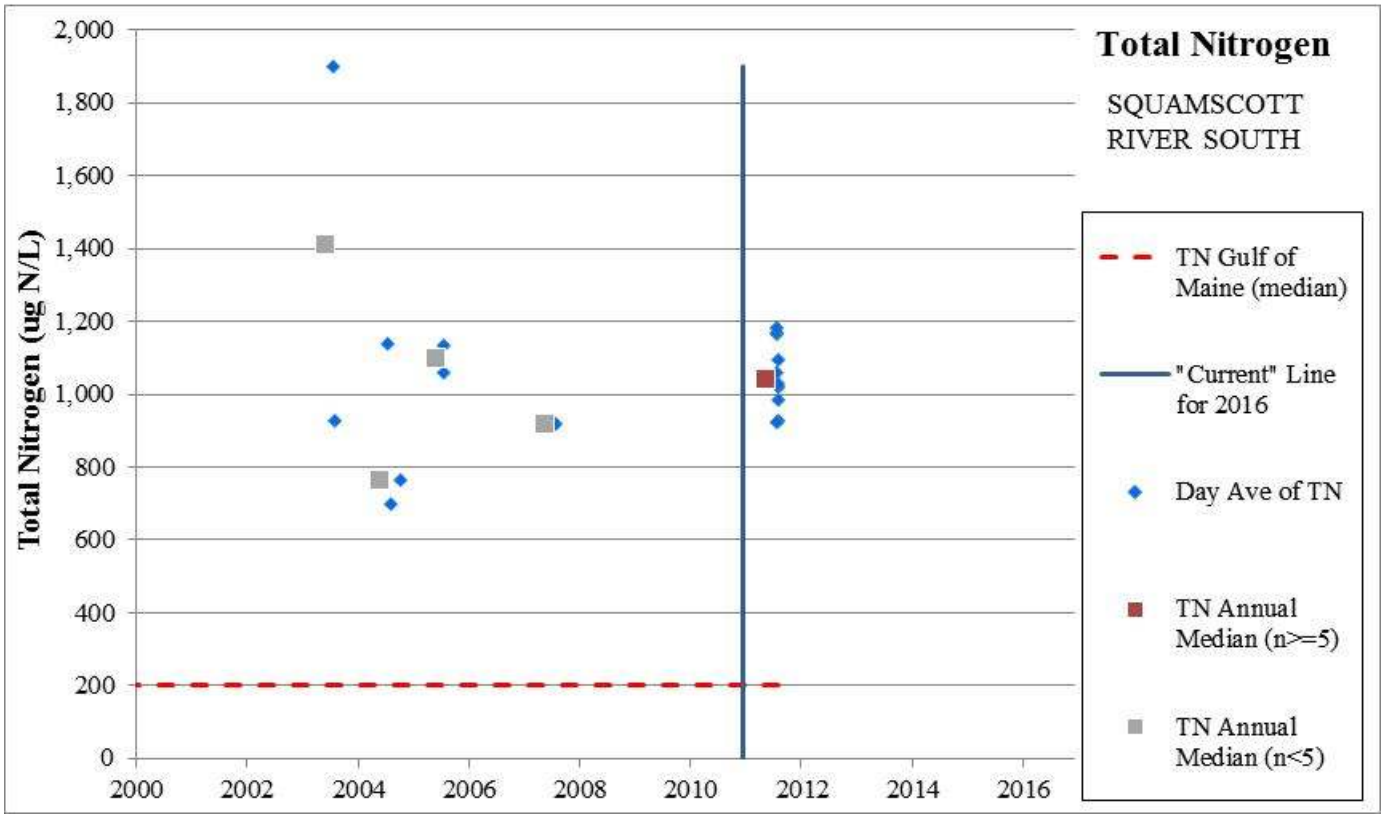
Indicator	Aquatic Life Use Category 2014 / 2016	2016 Comment
Chlorophyll-a	5-P / 5-P	No chlorophyll-a data has been collected in the Squamscott River South assessment zone since 2011, which was reported in the March 2012 report by HydroQual, consultants for the Great Bay Municipal Coalition (HydroQual, March 20, 2012). That data showed numerous measurements in this assessment zone of 50 to greater than 200 ug/L. The calculated 90th percentile chlorophyll-a in this assessment zone is 171 ug/L (n=22). The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. Additionally, there are still frequent dissolved oxygen concentration and percent saturation criteria exceedences.
Dissolved Oxygen (mg/L)	5-P / 5-P	The most recent dissolved oxygen data that has been collected in the Squamscott River South assessment zone was in 2011 and reported in March 2012 by HydroQual, consultants for the Great Bay Municipal Coalition (HydroQual, March 20, 2012).That data showed numerous violations of the dissolved oxygen concentration and the daily average (24 hour) percent saturation standards in this assessment zone. The report documents water quality sampling, including datasonde deployments, conducted by UNH in the Squamscott River in August and September 2011.
Dissolved Oxygen (% Saturation)	5-P / 5-P	See Above
Estuarine Bioassessments (eelgrass)	No Std / No Std	Not applicable. Eelgrass habitat has not historically existed in this assessment zone. This assessment zone was created for the 2012 cycle by splitting the Squamscott River assessment zone (assessment unit ID = NHEST600030806-01) into two pieces. The parent assessment zone was listed as impaired (5-P) for eelgrass loss on the 2010 303d list. For the 2012 list, the impairment was associated with the other child assessment zone (Squamscott River North; NHEST600030806-01-02) because eelgrass has not historically existed in this assessment zone.
Water Clarity (Light Attenuation Coefficient)	No Std / No Std	Not applicable. This assessment unit was created for the 2012 cycle by splitting the Squamscott River assessment zone (assessment unit ID = NHEST600030806-01) into two pieces. The parent assessment zone was listed as impaired (5-P) for water clarity to protect eelgrass habitat on the 2010 303d list. The impairment was contingent upon the Estuarine Bioassessments (eelgrass) impairment and therefore not retained on this assessment zone in 2012 because eelgrass has not historically existed in this assessment zone.
Total Nitrogen	5-P / 5-P	The median total nitrogen from 2011 through 2015 was 1,044 ug/L (n=10). This assessment zone experiences frequent dissolved oxygen concentrations well below 5 mg/L and daily average saturation below 75 percent. During some periods this assessment zone also demonstrates super saturation including multiple days in 2011 experiencing dissolved oxygen saturation over 125 percent and up to 169 percent in grab samples. The 90th percentile for chlorophyll-a concentration was 171 (n=22) from 2011 through 2015 including one sample measured at 234 ug/L. Many of the classic indicators of nutrient eutrophication are present in this assessment zone. As such, the impairment for nitrogen has been retained.


Chlorophyll-a
SQUAMSCOTT RIVER SOUTH
ug Chl-a / L
250
200
150
100
50
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
Chl-a Ind. (90th percentile)
"Current" Line for 2016
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN


Dissolved Oxygen Concentration
SQUAMSCOTT RIVER SOUTH
Dissolved Oxygen, mg / L
18
16
14
12
10
8
6
4
2
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2016
DO-PPM-GRAB-NCP
DO-PPM-GRAB-CP
DO-PPM-24HR-MIN-CP


Dissolved Oxygen Percent Saturation
SQUAMSCOTT RIVER SOUTH
Dissolved Oxygen, Percent Saturation
250
200
150
100
50
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2016
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP
DO-PERC-24H-MEAN-CP


Light Attenuation
SQUAMSCOTT RIVER SOUTH
Kd 1 / m (PAR) (lower is better)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
Min. for Survival Indicator (median)
"Current" Line for 2016
Light Attenuation Coefficient



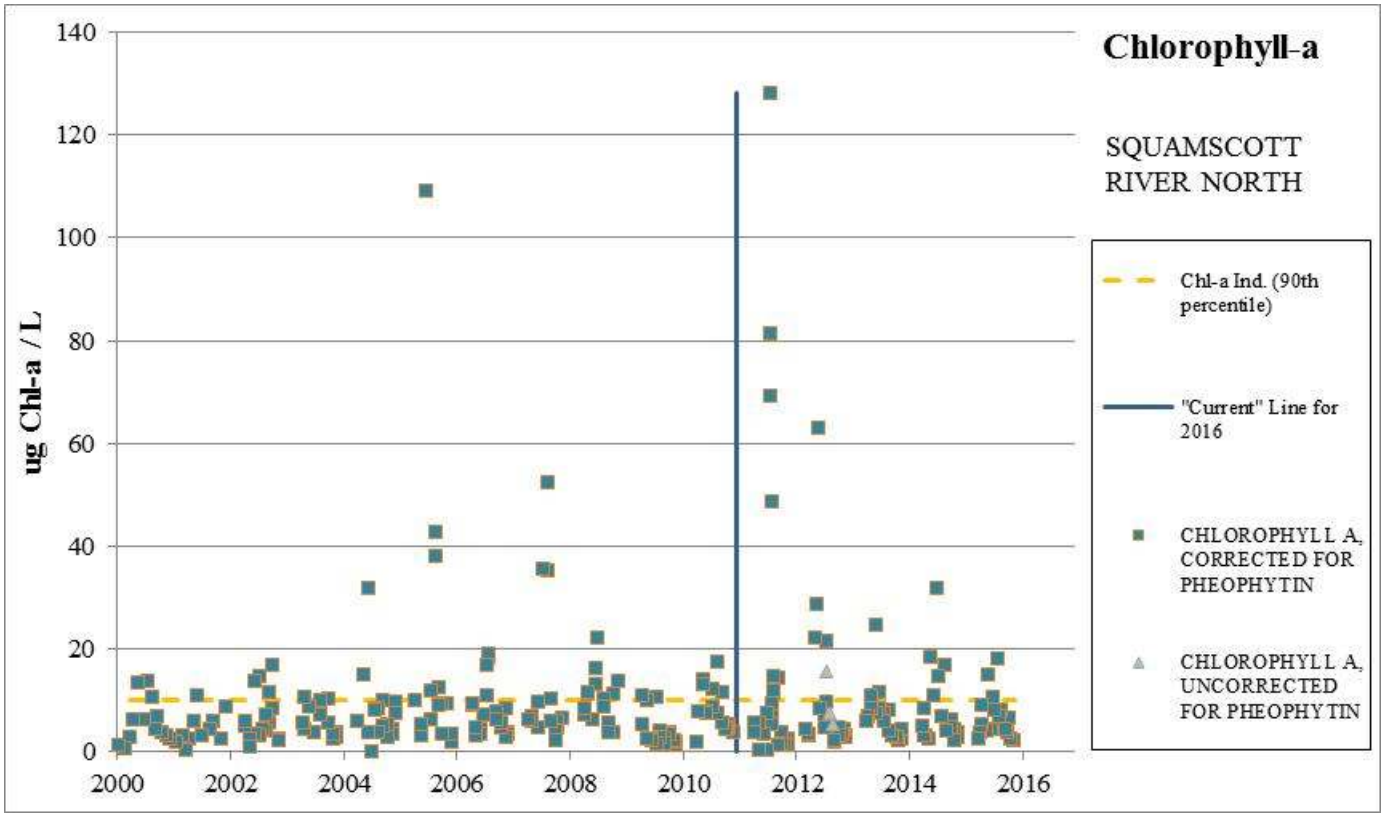
Squamscott River - South Assessment Zone	Count	Minimum	Median	90th Percentile	Maximum
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	22	5.2	26.1	**171.4**	233.8
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	0	-	-	-	-
CHLOROPHYLL A, combined	22	0.0	26.1	171.4	233.8
DO-PERC-24H-MEAN-CP	110	48.2	76.6	85.0	103.6
DO-PERC-24H-MEAN-NCP	0	-	-	-	-
DO-PERC-2TIDE-GRAB-CP	11	65.2	79.1	141.4	142.1
DO-PERC-2TIDE-GRAB-NCP	0	-	-	-	-
DO-PPM-24HR-MIN-CP	109	2.6	5.5	6.7	7.4
DO-PPM-24HR-MIN-NCP	0	-	-	-	-
DO-PPM-GRAB-CP	11	4.2	6.0	9.2	9.3
DO-PPM-GRAB-NCP	0	0.0	-	-	0.0
LIGHT ATTENUATION COEFFICIENT	19	2.035	**2.570**	3.600	3.830
TURBIDITY	86	0.3	26.7	1,900.6	2,457.0
Day Ave of TN	10	922	**1,044**	1,180	1,182
Day Ave of TDN	10	176	489	779	782
Day Ave of DIN (NH3 + NO2/3)	10	9	302	493	499
Day Ave of NH3	10	3	115	250	254
Day Ave of PON	5	171	298	-	521
Day Ave of NO2/3	10	9	155	208	210

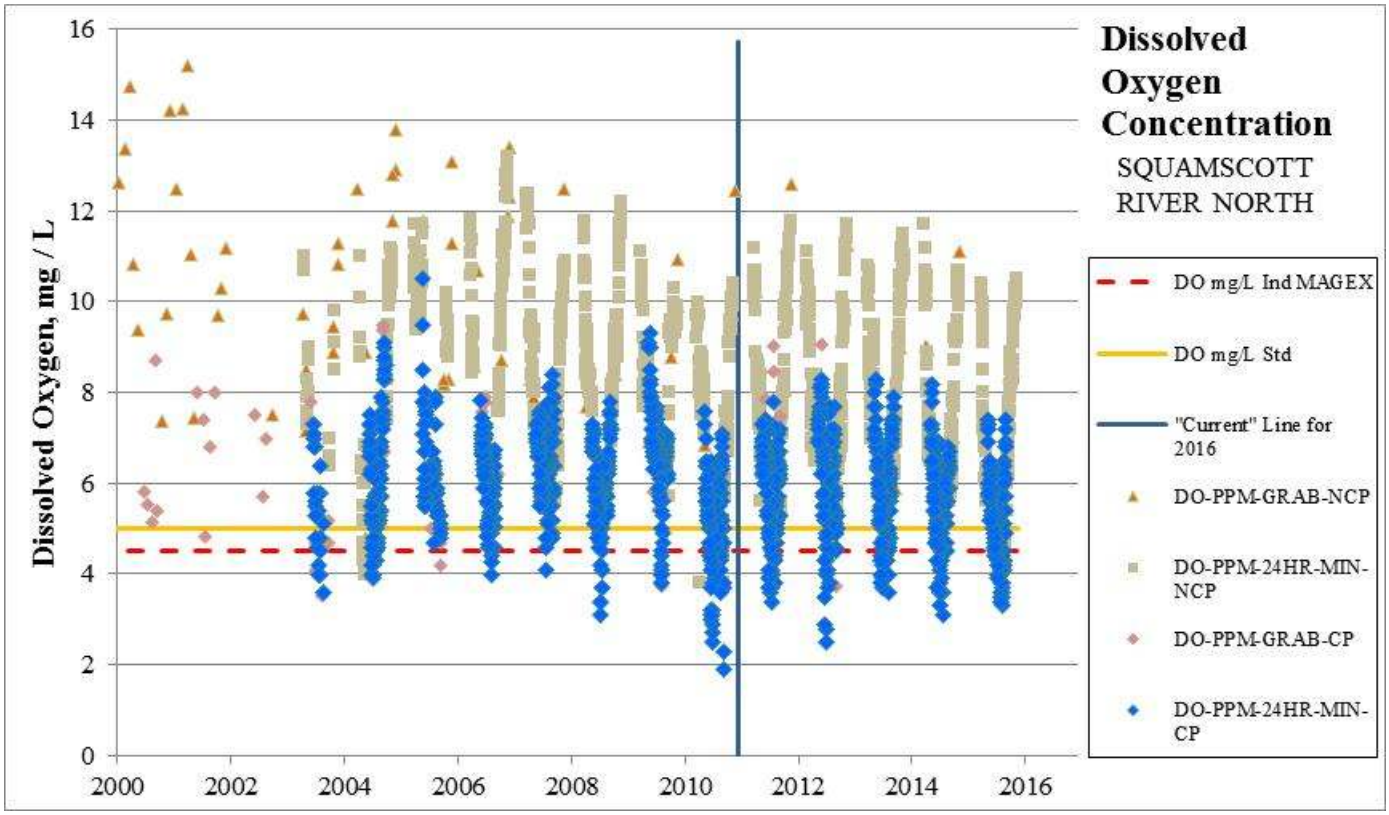
Assessment Zone = SQUAMSCOTT RIVER NORTH

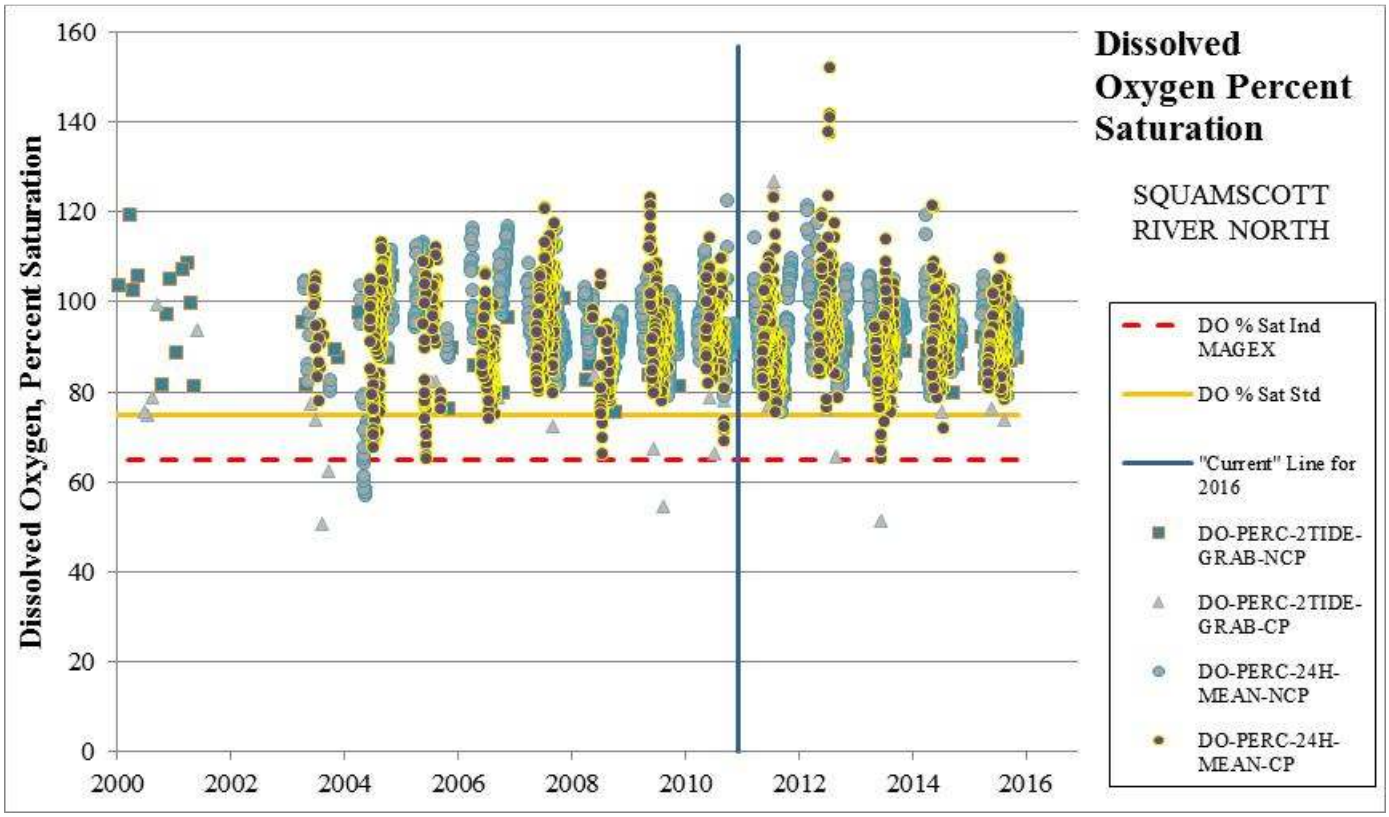
(NHEST600030806-01-02)

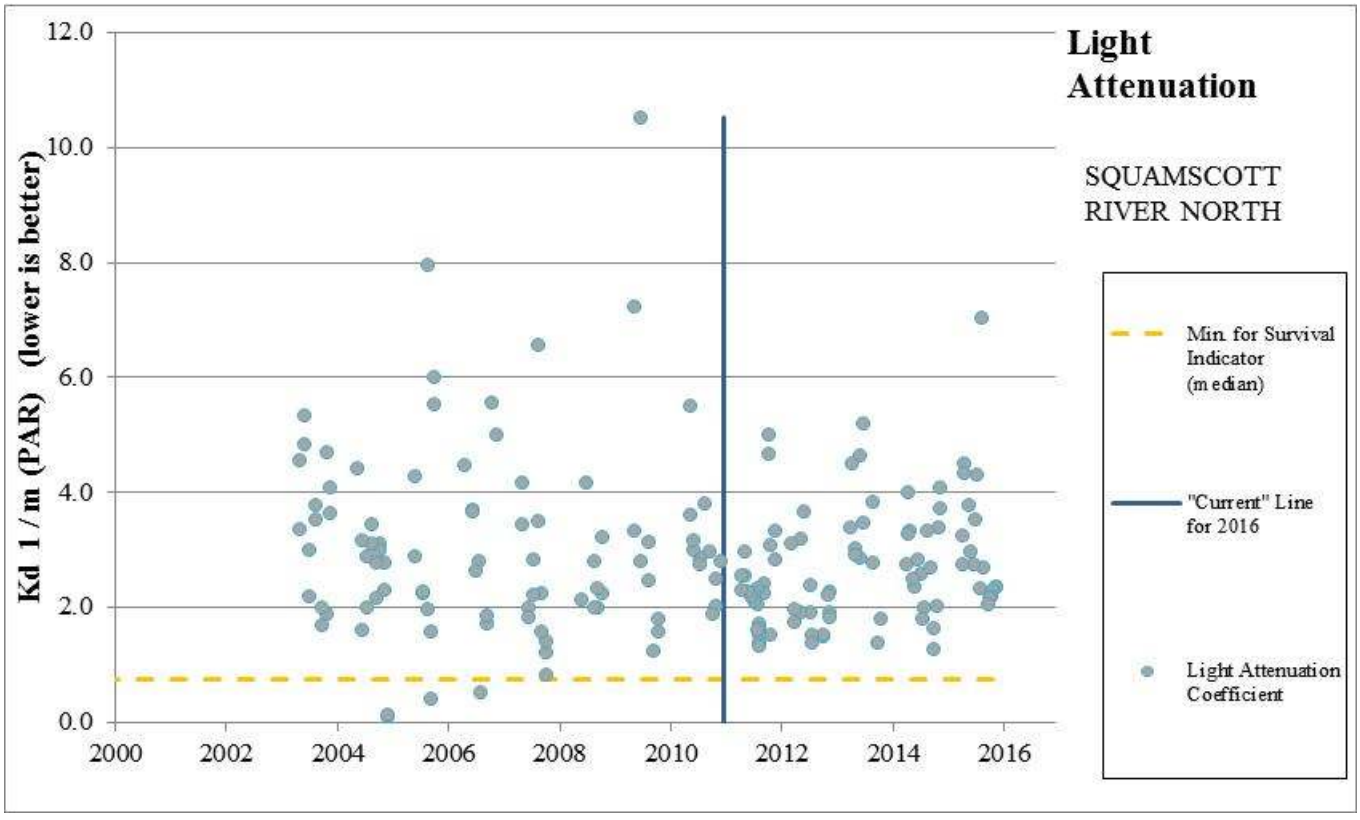
Indicator	Aquatic Life Use Category 2014 / 2016	2016 Comment
Chlorophyll-a	5-P / 5-P	Chlorophyll-a data has been collected in the Squamscott River North assessment zone every year since 2008. The 90th percentile for chlorophyll-a, is 22 ug/L (n=101) which includes multiple readings over 50 ug/L. The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. As noted in the March 20, 2012 HydroQual report, "…such elevated algal levels probably contribute to increased SOD which will contribute to lower DO when algal levels are low…" (HydroQual, March 20, 2012). Additionally, there are still frequent dissolved oxygen concentration criteria exceedences.
Dissolved Oxygen (mg/L)	5-P / 5-P	Dissolved oxygen concentration measurements in this assessment zone fall below the 5 mg/L criteria every year. Because a portion of those measurements fall below 4 mg/L each year, and in some years below 3 mg/L, this impairment is considered severe.
Dissolved Oxygen (% Saturation)	5-M / 5-M	Following the 10% method listed in the 2016 CALM this parameter would be categorized as 2-M. Part of the concept behind the 10% rule was to address random errors within the meter measurement accuracy, thereby limiting accidental impairments. The magnitude of exceedence criteria was layered into the assessment process to address major exceedences and exceedences beyond all normal measurement errors. In the case of this assessment zone there are 590 station/days of DO readings during the critical summer period. Two of the last five years of data show criteria exceedences sometimes on multiple days, which demonstrates that this phenomenon is not limited to a single summer. Looking back through the dataset, we see that this is a regularly occurring condition, further demonstrating that this phenomenon is not limited to a single summer. It is clear that it is common in this assessment zone to have 24 hour average dissolved oxygen below 75 percent. While no 24 hour average dissolved oxygen readings fell below the magnitude of exceedence indicator of 65 percent, there were several close values (e.g. 65.4 percent average on July 10, 2013).
Estuarine Bioassessments (eelgrass)	5-P / 5-P	In the 2012 assessment cycle, this assessment zone was listed as impaired for "Estuarine Bioassessments" (i.e. a lack of eelgrass) based on the 1948 survey that indicated that roughly 42 acres of eelgrass were present and despite intensive mapping efforts since 1981, eelgrass has never again been documented in this zone. While the 1948 map is rough enough that we cannot say that precisely 42 acres of eelgrass were present, its presence was clearly documented. Combined with the application of the Eelgrass Site Selection Model (Short, Davis, Kopp, Short, & Burdick, 2002) and a rudimentary suitability evaluation of temperature and salinity leads one to conclude that eelgrass should be present. Taken in totality, there is insufficient evidence to remove the 2014 "Estuarine Bioassessment" impairment. As such, the impairment for "Estuarine Bioassessments" and "Water Clarity (Light Attenuation Coefficient)" has been retained on the 2016 final 303(d).
Water Clarity (Light Attenuation Coefficient)	5-P / 5-P	Median=2.42 m^-1 (n=89). For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1. Therefore, the impaired (5-M) listing from the 2014 303d list has been retained.
Total Nitrogen	5-P / 5-P	The median total nitrogen from 20011 through 2015 was 709 ug/L (n=93). This assessment zone continues to experience frequently dissolved oxygen concentrations well below 5 mg/L and periodic readings below the 24 hour average 75 percent saturation criteria. During some periods this assessment zone also demonstrates severe super saturation including multiple days in 2012 experiencing 24 hour average dissolved oxygen saturation in excess of 125 percent and as high as 152 percent. The chlorophyll-a concentration 90th percentile was 22 (n=101) from 2011 through 2015 and multiple samples were over 50 ug/L including one sample measured at 128 ug/L. As noted in the March 20, 2012 HydroQual report, "The substantial reduction in the concentration of algal cells that settle to the river bottom and contribute to river SOD as a consequence of a reduction in the Exeter WWTP effluent nitrogen will increase Squamscott River minimum DO levels and possibly attain the

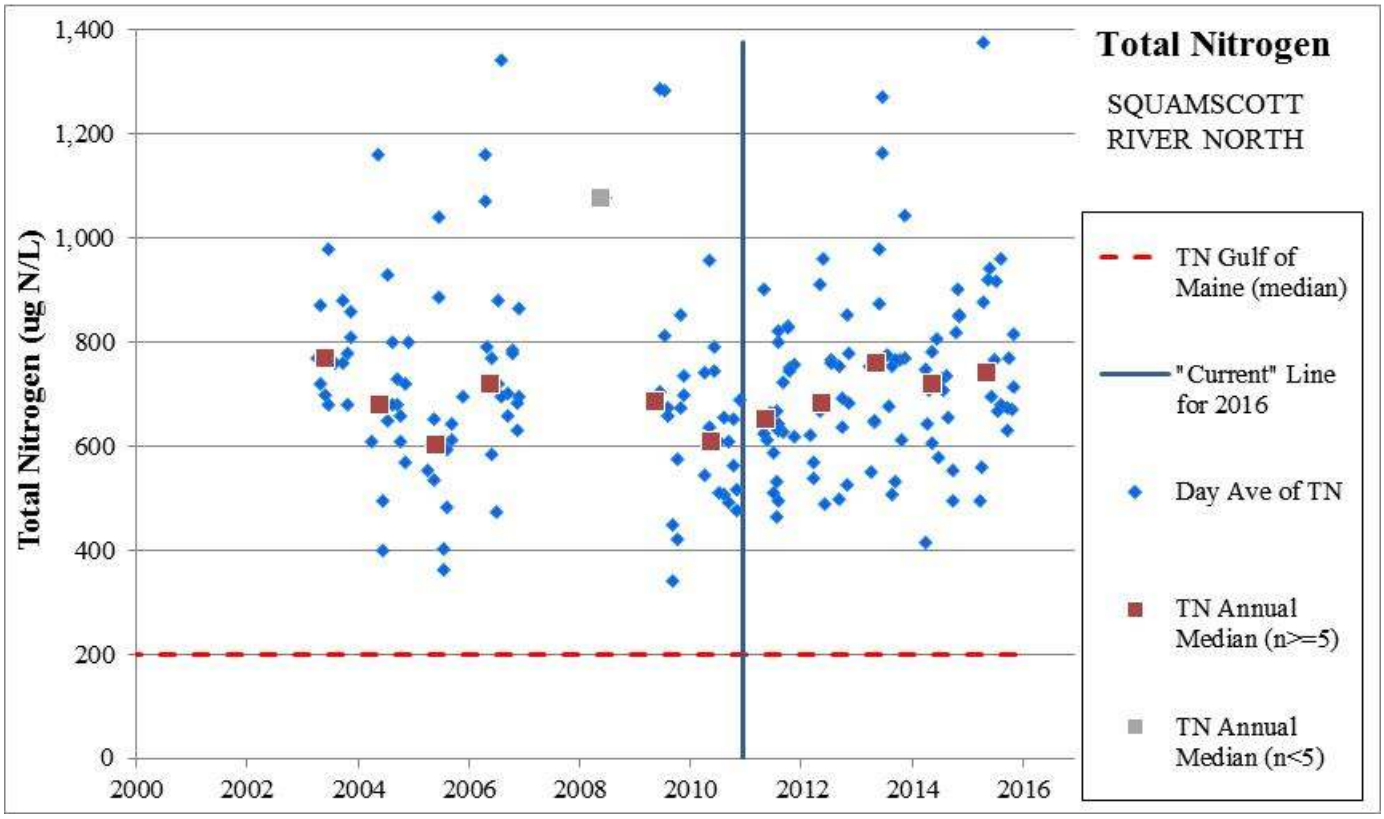
		DO standard." (HydroQual, March 20, 2012). Many of the classic indicators of nutrient eutrophication are present in this assessment zone. As such, the impairment for nitrogen has been retained.






Dissolved Oxygen Percent Saturation
SQUAMSCOTT RIVER NORTH
Dissolved Oxygen, Percent Saturation
160
140
120
100
80
60
40
20
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2016
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP
DO-PERC-24H-MEAN-NCP
DO-PERC-24H-MEAN-CP


Light Attenuation
SQUAMSCOTT RIVER NORTH
Kd 1 / m (PAR) (lower is better)
12.0
10.0
8.0
6.0
4.0
2.0
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
Min. for Survival Indicator (median)
"Current" Line for 2016
Light Attenuation Coefficient

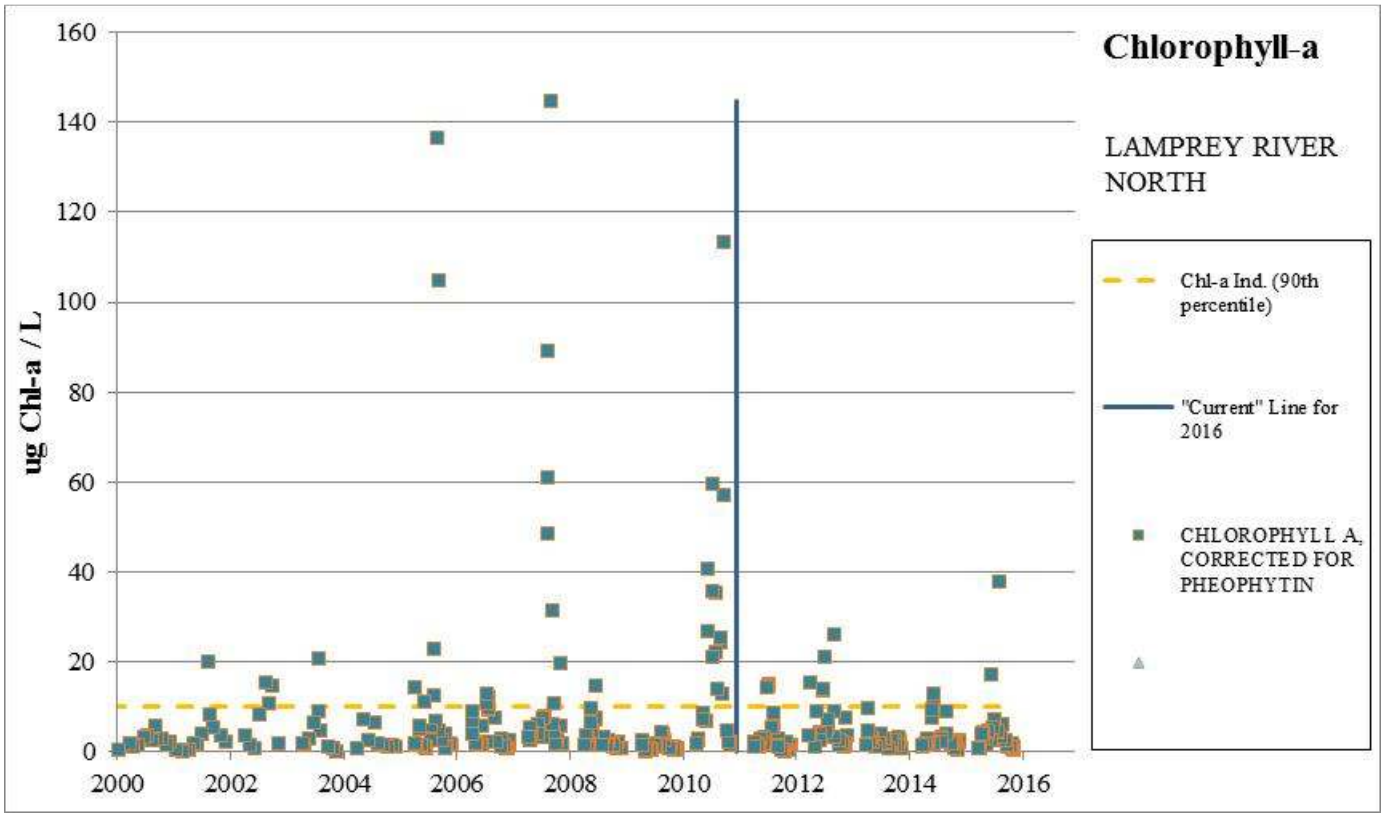


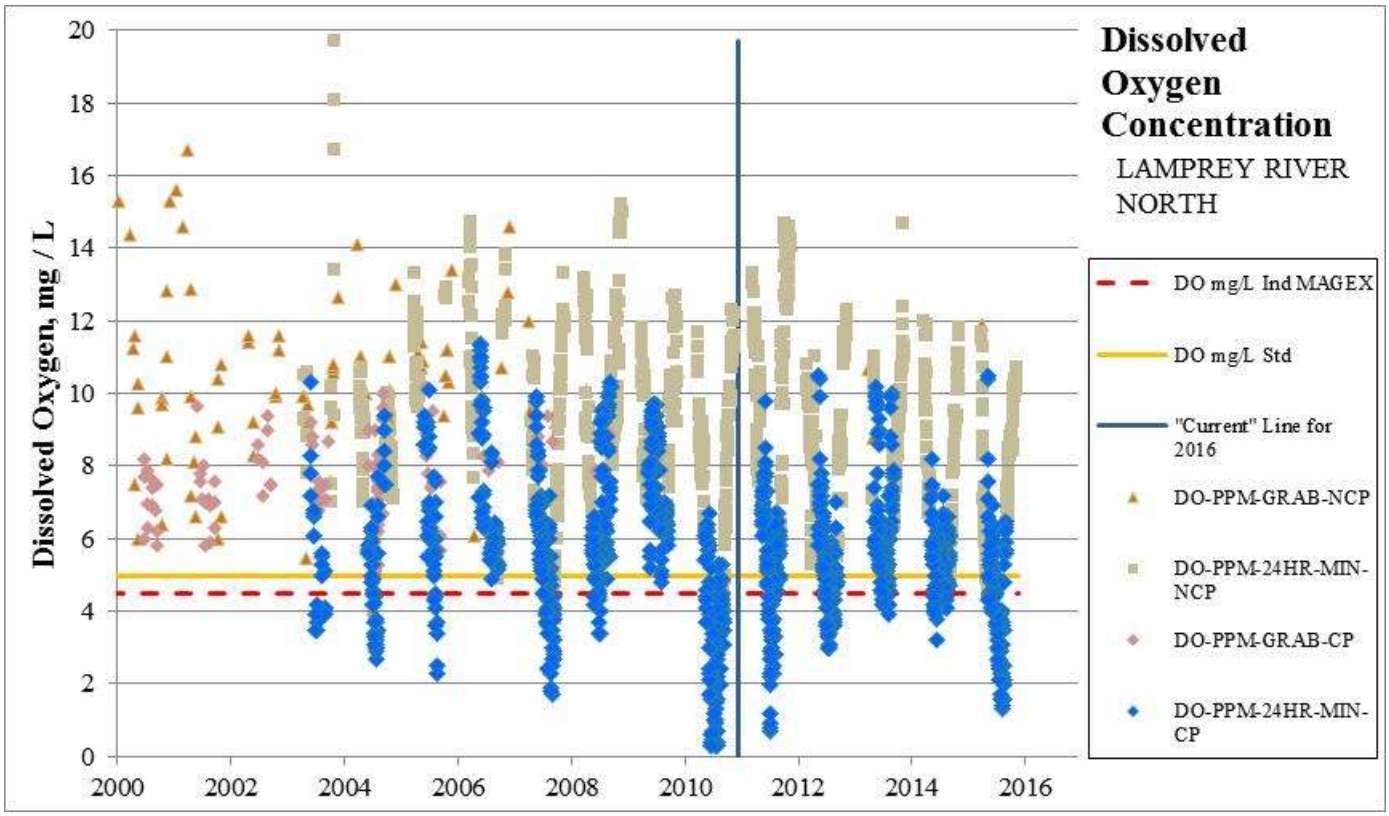
Squamscott River - North Assessment Zone	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	98	0.4	5.2	**21.8**	128.0
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	3	5.4	7.5	-	15.6
CHLOROPHYLL A, combined	101	0.4	5.4	21.8	128.0
DO-PERC-24H-MEAN-CP	590	65.4	91.7	104.1	152.0
DO-PERC-24H-MEAN-NCP	574	75.7	94.0	104.3	121.7
DO-PERC-2TIDE-GRAB-CP	21	51.5	86.2	121.1	127.0
DO-PERC-2TIDE-GRAB-NCP	22	79.7	88.5	92.2	92.4
DO-PPM-24HR-MIN-CP	592	2.5	5.8	7.2	8.3
DO-PPM-24HR-MIN-NCP	586	4.7	8.4	10.7	11.8
DO-PPM-GRAB-CP	22	3.8	5.9	8.9	9.1
DO-PPM-GRAB-NCP	25	5.9	9.0	11.2	12.6
LIGHT ATTENUATION COEFFICIENT	89	1.300	**2.420**	4.320	7.050
TURBIDITY	1,135	2.0	15.0	60.0	1,906.0
Day Ave of TN	93	416	**709**	918	1,376
Day Ave of TDN	97	180	550	684	948
Day Ave of DIN (NH3 + NO2/3)	97	13	323	558	686
Day Ave of NH3	97	3	179	378	569
Day Ave of PON	3	177	243	-	293
Day Ave of NO2/3	97	9	130	221	301

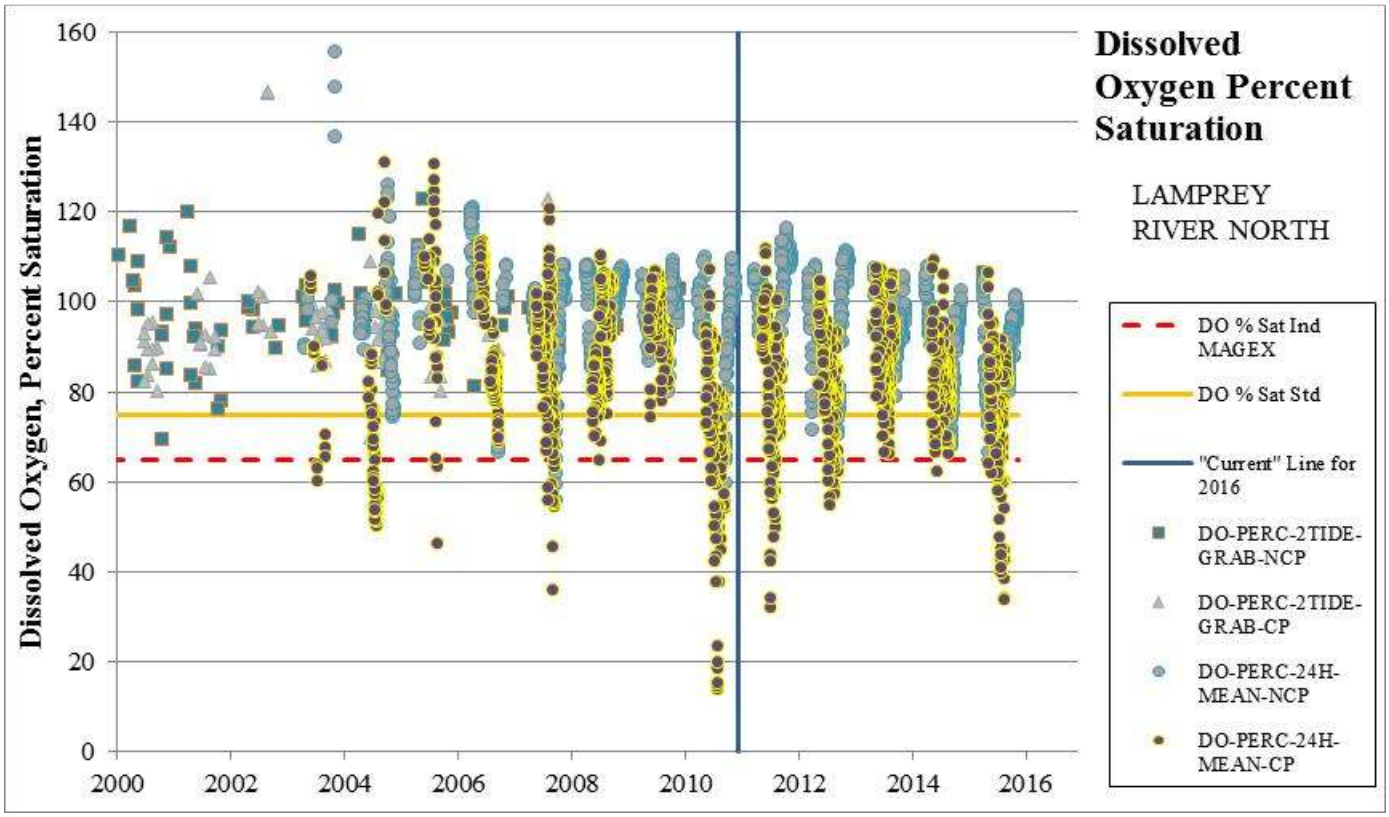
Assessment Zone = LAMPREY RIVER NORTH

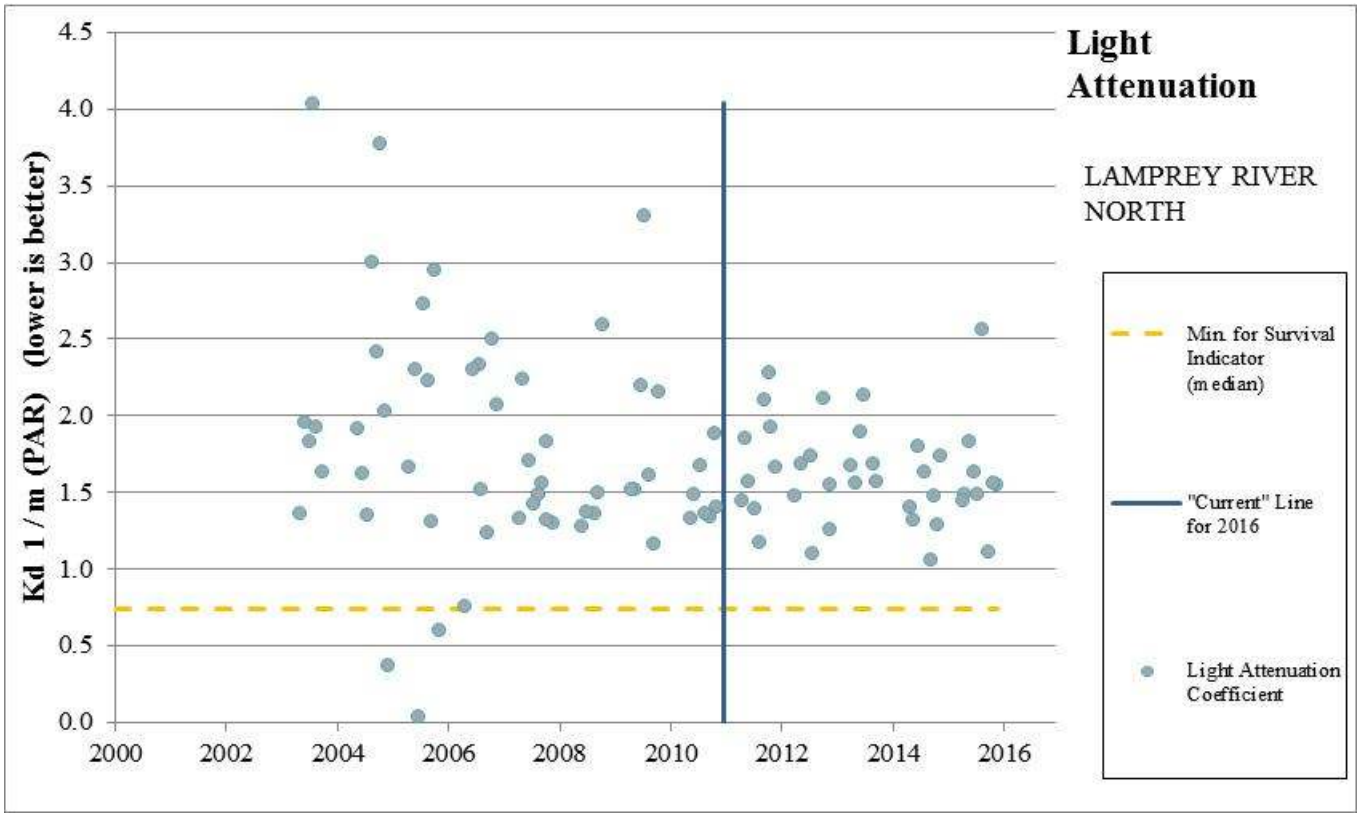
(NHEST600030709-01-01)

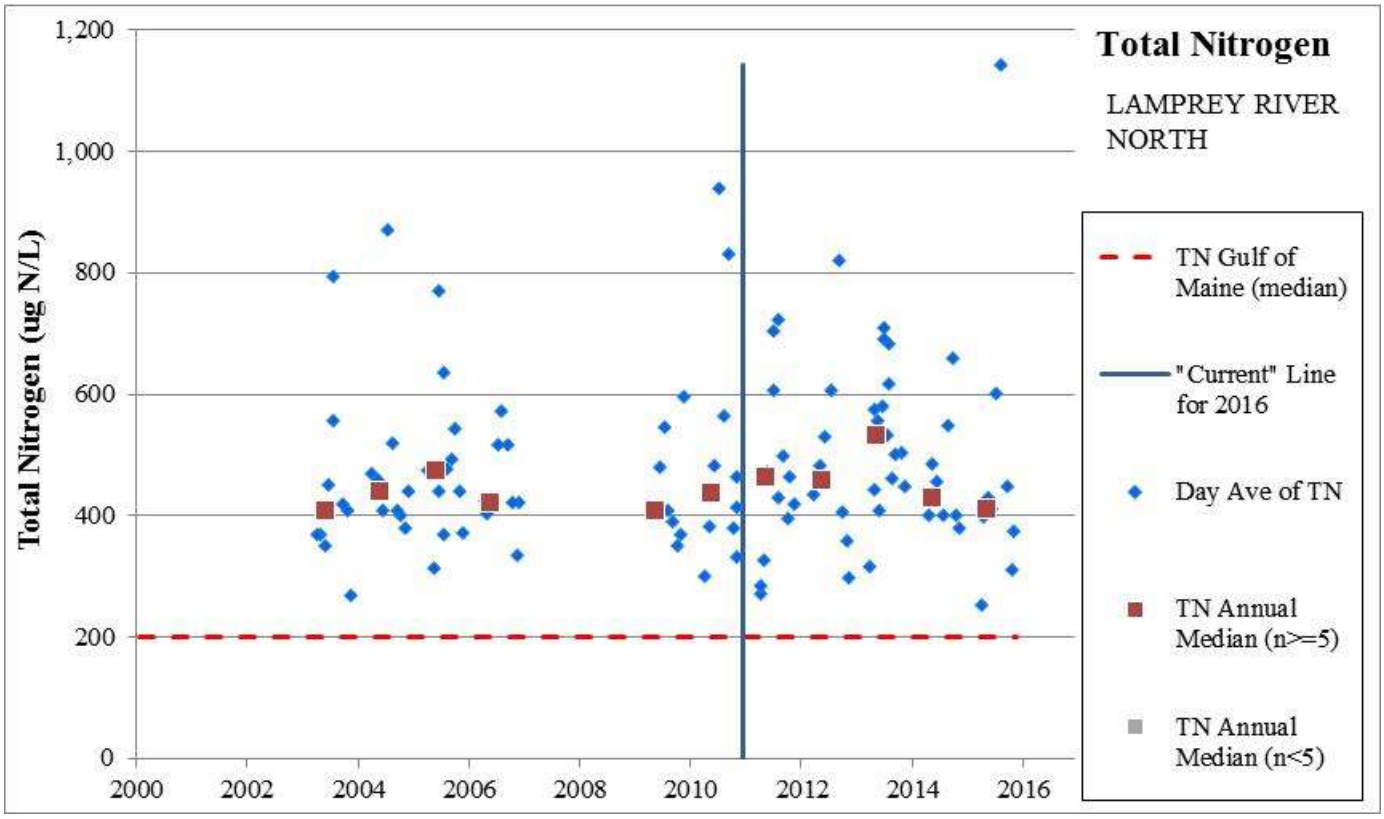
Indicator	Aquatic Life Use Category 2014 / 2016	2016 Comment
Chlorophyll-a	5-M / 5-M	The calculated 90th percentile chlorophyll-a in this assessment zone is 9.7 ug/L (n = 131) and the zone had a maximum reading of 38 ug/L. The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. Additionally, there are still frequent dissolved oxygen concentration and percent saturation criteria exceedences. Large nutrient load reductions are anticipated when the new waste water treatment facility comes online in 2017. The chlorophyll-a impairment has been retained.
Dissolved Oxygen (mg/L)	5-P / 5-P	Dissolved oxygen concentration measurements in this assessment zone fall below the 5 mg/L criteria every year. Because a portion of those measurements fall below 4 mg/L each year, and in some years below 1 mg/L, this impairment is considered severe.
Dissolved Oxygen (% Saturation)	5-P / 5-P	Dissolved oxygen 24 hour average percent saturation measurements in this assessment zone fall below the 75 percent criteria every year. Because a portion of those measurements fall below 65 percent each year, and in some years below 40 percent, this impairment is considered severe.
Estuarine Bioassessments (eelgrass)	No Std / No Std	Not applicable. Eelgrass habitat has not historically existed in this assessment zone.
Water Clarity (Light Attenuation Coefficient)	No Std / No Std	Not applicable. The water clarity has not been assessed because eelgrass has not historically existed in this assessment zone.
Total Nitrogen	5-M / 5-M	The median total nitrogen from 2011 through 2015 was 463 ug/L (n=53). This assessment zone experiences frequent dissolved oxygen concentrations well below 5 mg/L and daily average saturation below 75 percent. During some periods this assessment zone also demonstrates super saturation including multiple days in 2012 and a few dates in 2011 experiencing dissolved oxygen saturation over 125 percent. The chlorophyll-a concentration 90th percentile was 9.7 ug/L (n=131) from 2011 through 2015 and concentrations up to 38 ug/L. Many of the classic indicators of nutrient eutrophication are present in this assessment zone. As such, the impairment for nitrogen has been retained.


Chlorophyll-a
LAMPREY RIVER NORTH
ug Chl-a / L
160
140
120
100
80
60
40
20
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
Chl-a Ind. (90th percentile)
"Current" Line for 2016
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN


Dissolved Oxygen Concentration
LAMPREY RIVER NORTH
Dissolved Oxygen, mg / L
20
18
16
14
12
10
8
6
4
2
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2016
DO-PPM-GRAB-NCP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-24HR-MIN-CP


Dissolved Oxygen Percent Saturation
LAMPREY RIVER NORTH
Dissolved Oxygen, Percent Saturation
160
140
120
100
80
60
40
20
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2016
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP
DO-PERC-24H-MEAN-NCP
DO-PERC-24H-MEAN-CP


Light Attenuation
LAMPREY RIVER NORTH
Kd 1 / m (PAR) (lower is better)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
Min. for Survival Indicator (median)
"Current" Line for 2016
Light Attenuation Coefficient

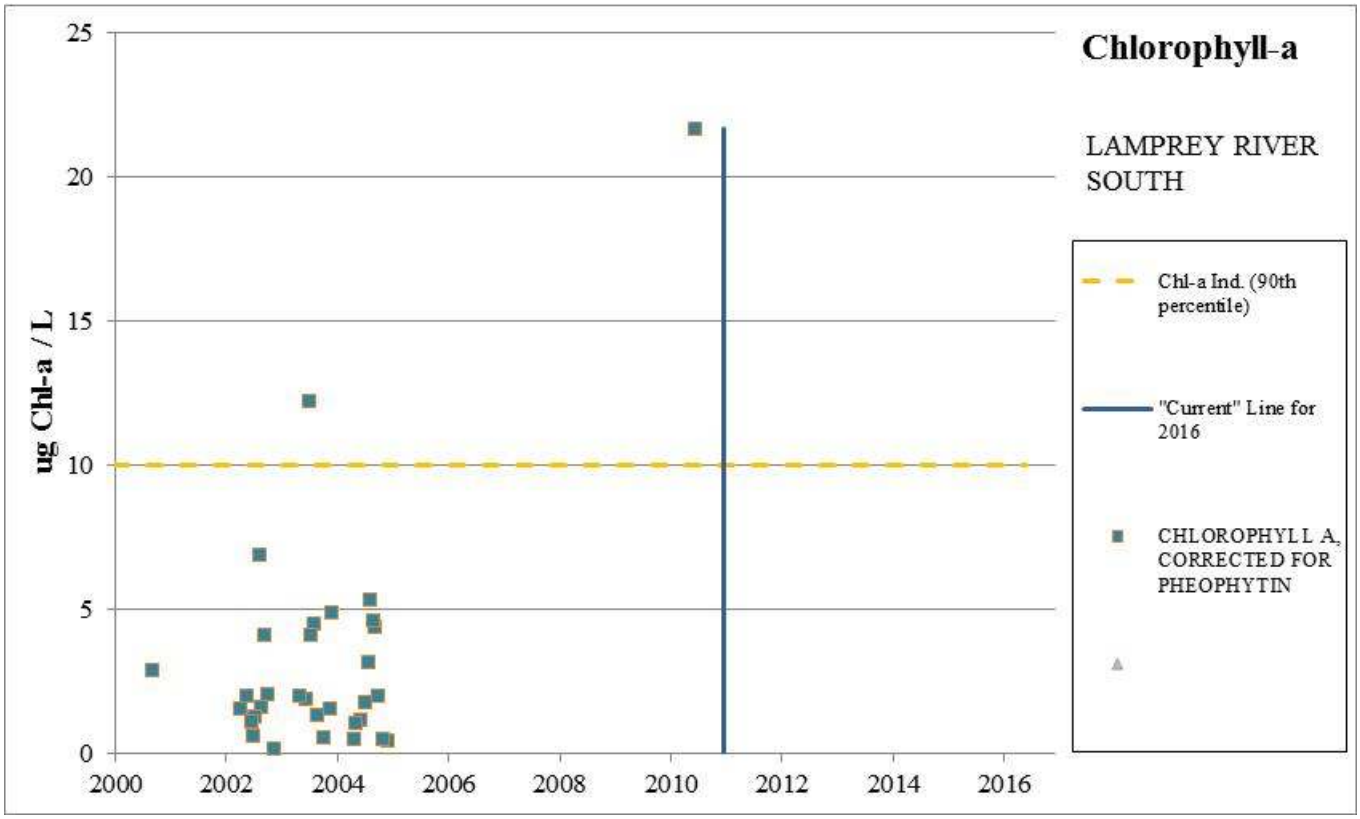


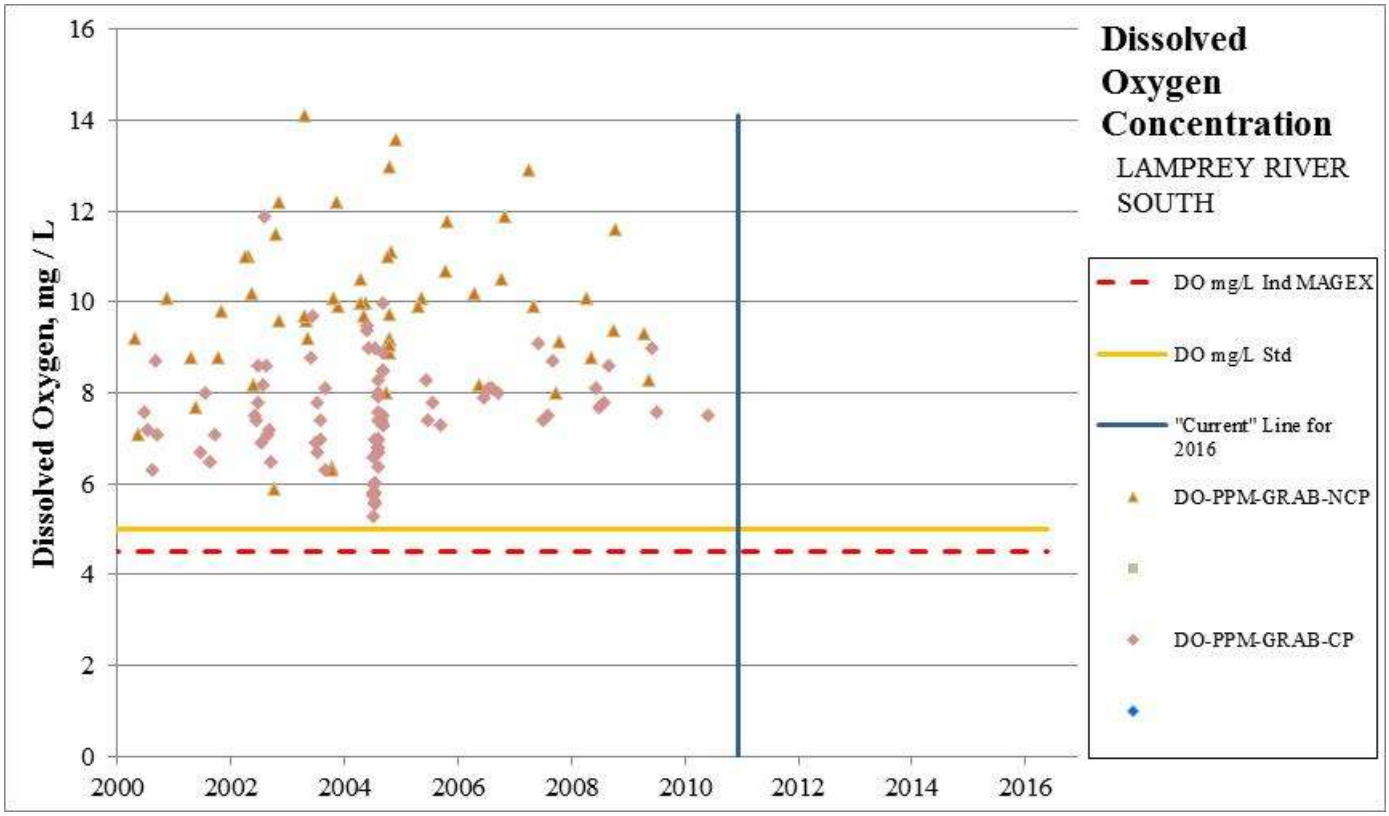
Lamprey River - North Assessment Zone	Count	Minimum	Median	90th Percentile	Maximum
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	131	0.2	2.5	**9.7**	38.0
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	0	-	-	-	-
CHLOROPHYLL A, combined	131	0.0	2.5	9.7	38.0
DO-PERC-24H-MEAN-CP	594	32.2	82.6	99.1	111.9
DO-PERC-24H-MEAN-NCP	536	64.5	97.3	108.9	116.6
DO-PERC-2TIDE-GRAB-CP	0	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP	2	94.5	100.4	-	106.4
DO-PPM-24HR-MIN-CP	589	0.7	5.4	7.3	10.5
DO-PPM-24HR-MIN-NCP	531	4.7	9.1	12.0	14.7
DO-PPM-GRAB-CP	0	-	-	-	-
DO-PPM-GRAB-NCP	4	8.8	11.3	-	14.1
LIGHT ATTENUATION COEFFICIENT	39	1.070	**1.585**	2.130	2.580
TURBIDITY	1,120	0.0	5.0	17.0	1,555.0
Day Ave of TN	53	254	**463**	698	1,144
Day Ave of TDN	132	211	466	670	1,027
Day Ave of DIN (NH3 + NO2/3)	132	31	333	566	1,035
Day Ave of NH3	132	3	193	448	691
Day Ave of PON	0	-	-	-	-
Day Ave of NO2/3	132	21	134	248	453

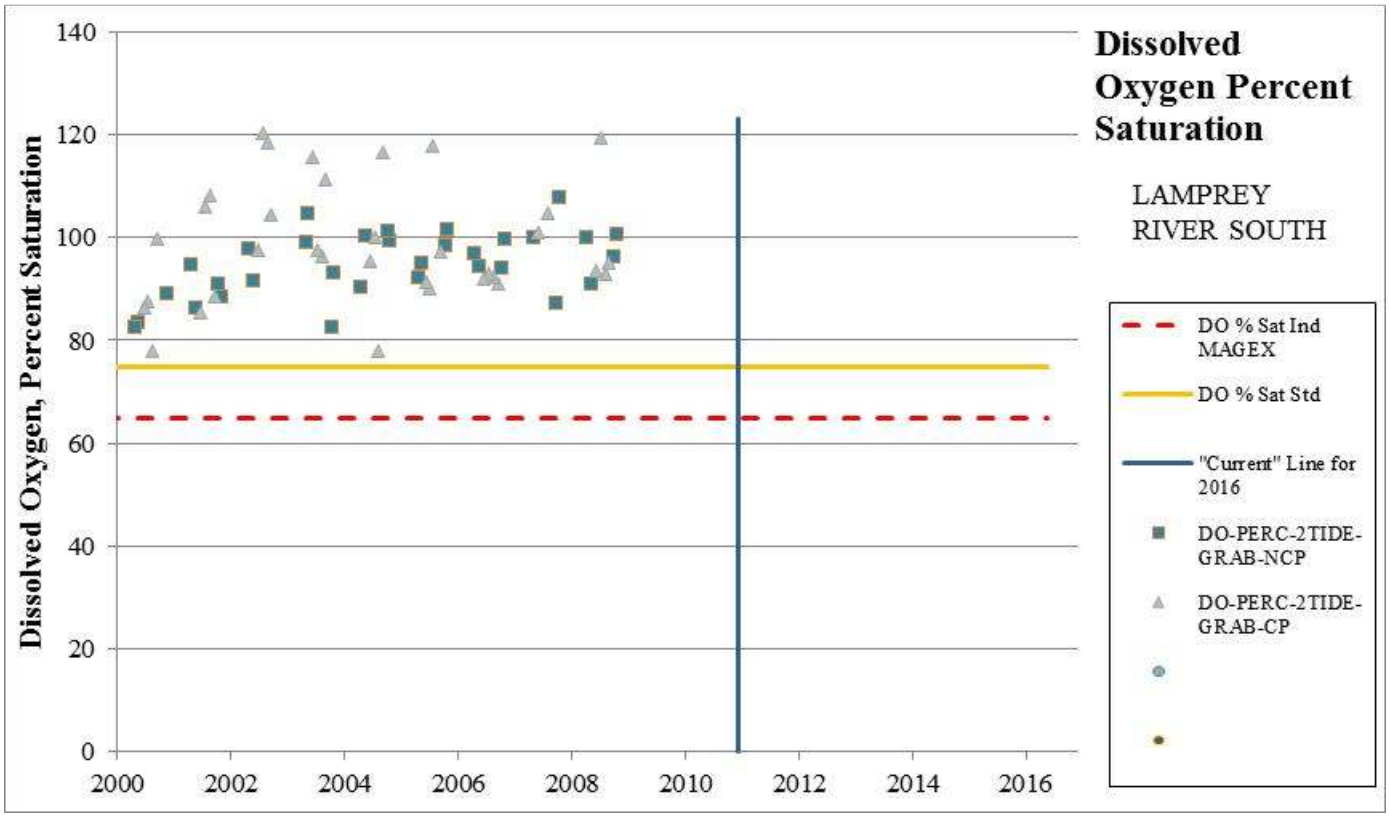
Assessment Zone = LAMPREY RIVER SOUTH

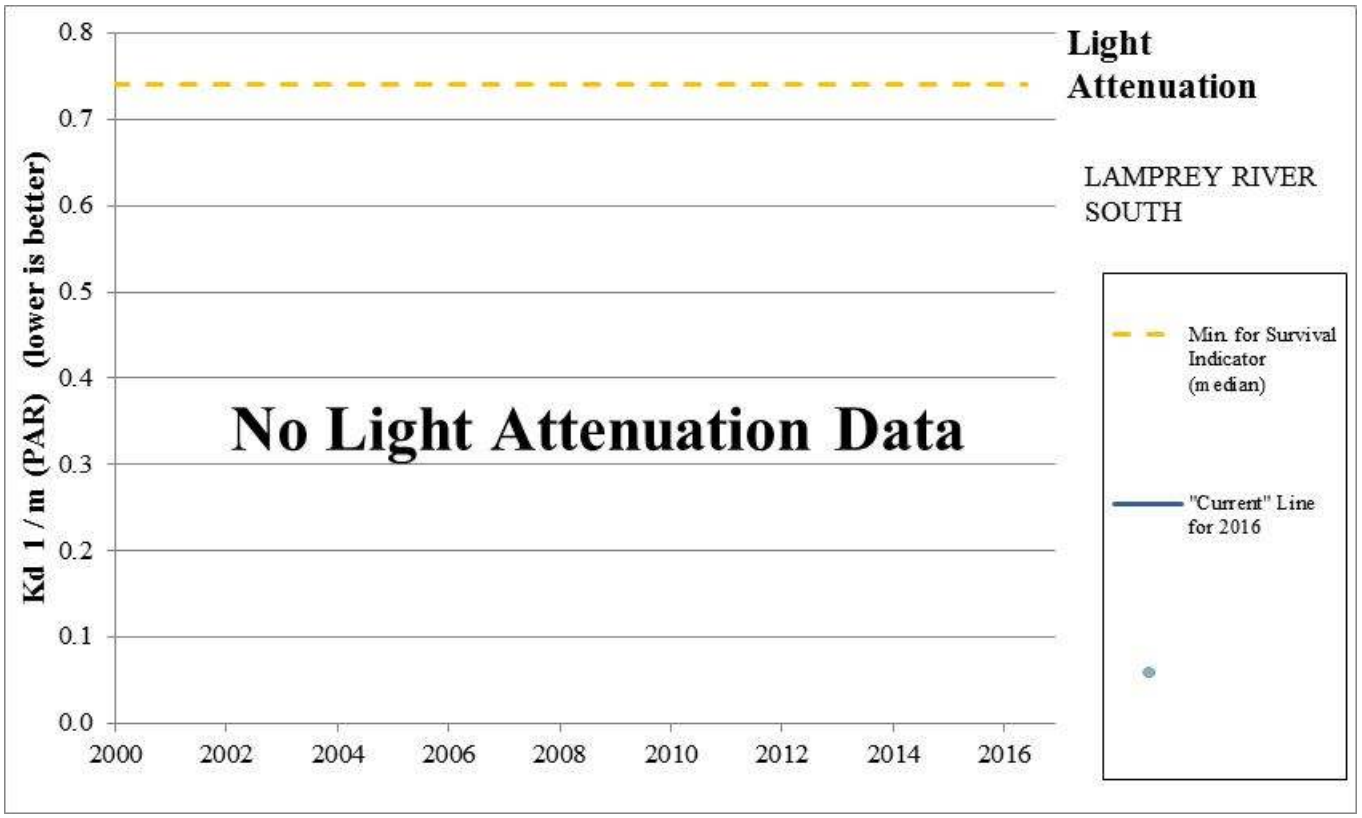
(NHEST600030709-01-02)

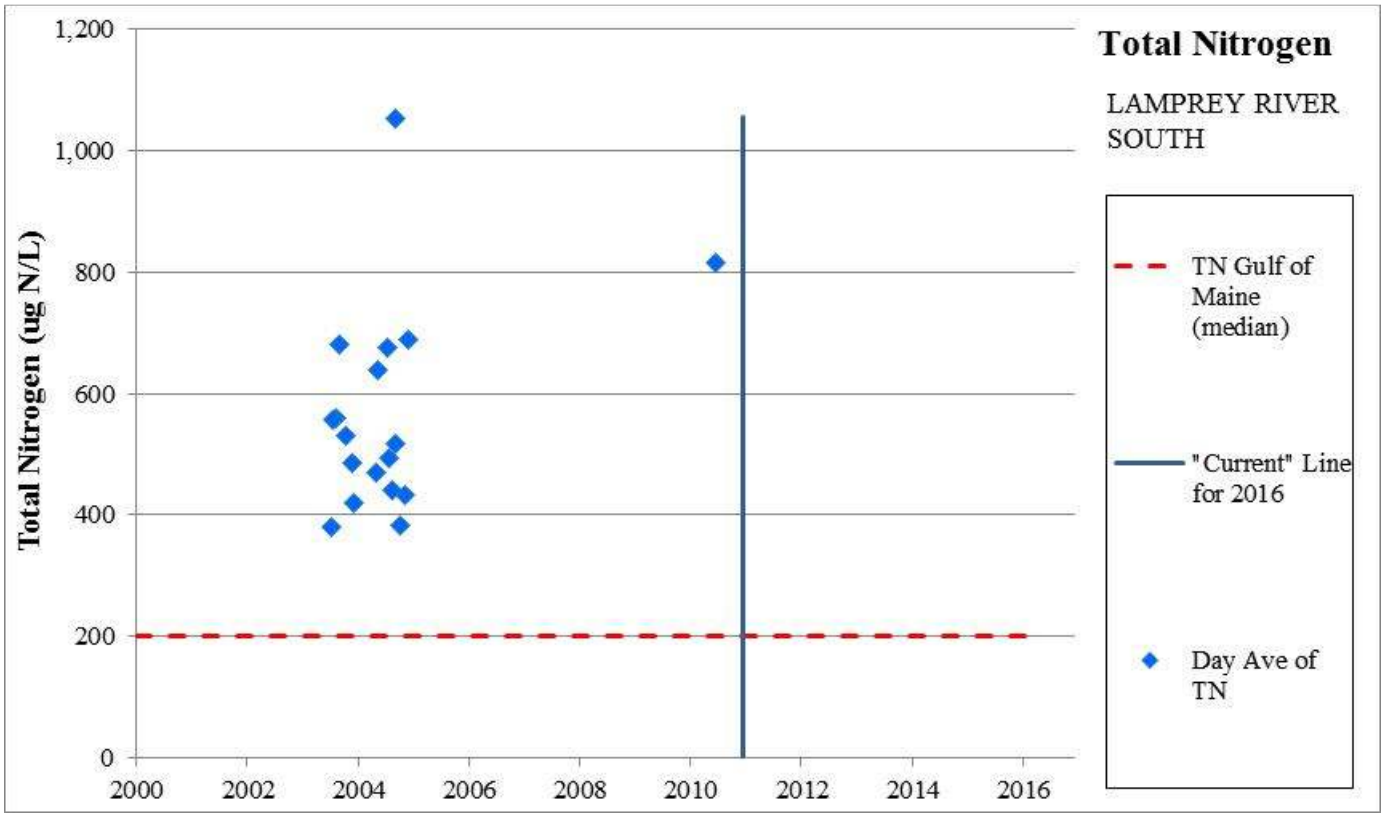
Indicator	Aquatic Life Use Category 2014 / 2016	2016 Comment
Chlorophyll-a	5-M / 5-M	The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. However, there are no available chlorophyll-a data for this assessment zone since 2008. Assessment zones that were impaired in the previous cycle cannot be removed from the 303d list if there are insufficient data to make a new assessment. Therefore, the 2014 impairment category of 5-M has been retained until additional monitoring occurs.
Dissolved Oxygen (mg/L)	2-G / 3-ND	This assessment zone has no measurements for dissolved oxygen concentration since 2009. As such, this assessment zone has been assessed as 3-ND (No Data) dissolved oxygen concentration
Dissolved Oxygen (% Saturation)	3-PAS / 3-ND	This assessment zone has no measurements for dissolved oxygen percent saturation since 2008. As such, this assessment zone has been assessed as 3-ND (No Data) for dissolved oxygen percent saturation.
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 53.4 acres from the 1948 dataset. Patches of eelgrass were found in 2003 (2.2 acres) and 2011 (0.5 acres). The median current extent of eelgrass in 2014-2016 is 0 acres, which is a 100% decrease. Since 1990, the trend in eelgrass cover in this assessment zone could not be determined because the eelgrass cover has been zero for most years since 1981. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	5-P / 5-P	The median light attenuation could not be calculated for the 2011 through 2015 period (n=0) within this assessment zone. For an eelgrass restoration depth of 2 m, the light attenuation coefficient indicator threshold is 0.75 m^-1. This assessment zone historically had eelgrass growing in both the shallows and deeper habitat making the 2m restoration depth a valid target. This assessment unit (zone) was created for the 2012 cycle by splitting the Lamprey River assessment unit (NHEST600030709-01) into two pieces. The parent assessment zone was listed as impaired (5-P) for water clarity based on data from station GRBLR to protect eelgrass habitat on the 2010 303d list. The GRBLR station is roughly 0.5 miles upstream (north) of the Lamprey River North/South split and has a median light attenuation coefficient of 1.59 m^-1 (n=39) for the 2011 through 2015 period. The downstream boundary to the Lamprey River South assessment zone is Great Bay, which had a Median=1.50 m^-1 (n=128) for the 2011 through 2015 period. Assessment zones that were impaired in the previous cycle cannot be removed from the 303d list if there are insufficient data to make a new assessment. Given the lack of new site specific data and the measurements upstream and downstream of this assessment zone the impaired (5-P) listing from the 2014 303d list has been retained.
Total Nitrogen	5-M / 5-M	The median total nitrogen could not be calculated for the 2011 through 2015 period (n=0) within this assessment zone. Due to a lack of available current data, dissolved oxygen cannot be assessed. The calculated 90th percentile chlorophyll-a in this assessment zone cannot be calculated due to a lack of data. The eelgrass beds have been eliminated. The median light attenuation coefficient was not calculated due to no samples collected in the 2011 through 2015 period in this assessment zone, however, both the upstream and downstream assessment zones are impaired due to the poor light attenuation coefficient. This assessment zone is generally characterized by its lack eutrophication indicator data. What it lacks in local data it makes up for in data from neighboring assessment zones. The upstream Lamprey River North assessment zone has extensive datasets demonstration impairments due to elevated chlorophyll-a and severely depleted dissolved oxygen. The downstream Great Bay assessment zone has marginally elevated chlorophyll-a and dissolved oxygen due to the severely poor condition coming out of the Squamscott River assessment zone as well as degraded eelgrass, poor light transmittance, and evidence of macroalgae. Taken in totality, there is insufficient evidence to remove the 2014 total nitrogen impairment. As such, the impairment for nitrogen has been retained.


Chlorophyll-a
LAMPREY RIVER SOUTH
ug Chl-a / L
25
20
15
10
5
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
Chl-a Ind. (90th percentile)
"Current" Line for 2016
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN


Dissolved Oxygen Concentration
LAMPREY RIVER SOUTH
Dissolved Oxygen, mg / L
16
14
12
10
8
6
4
2
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2016
DO-PPM-GRAB-NCP
DO-PPM-GRAB-CP


Dissolved Oxygen Percent Saturation
LAMPREY RIVER SOUTH
Dissolved Oxygen, Percent Saturation
140
120
100
80
60
40
20
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2016
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP


Light Attenuation
LAMPREY RIVER SOUTH
Kd 1 / m (PAR) (lower is better)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
No Light Attenuation Data
Min. for Survival Indicator (median)
"Current" Line for 2016

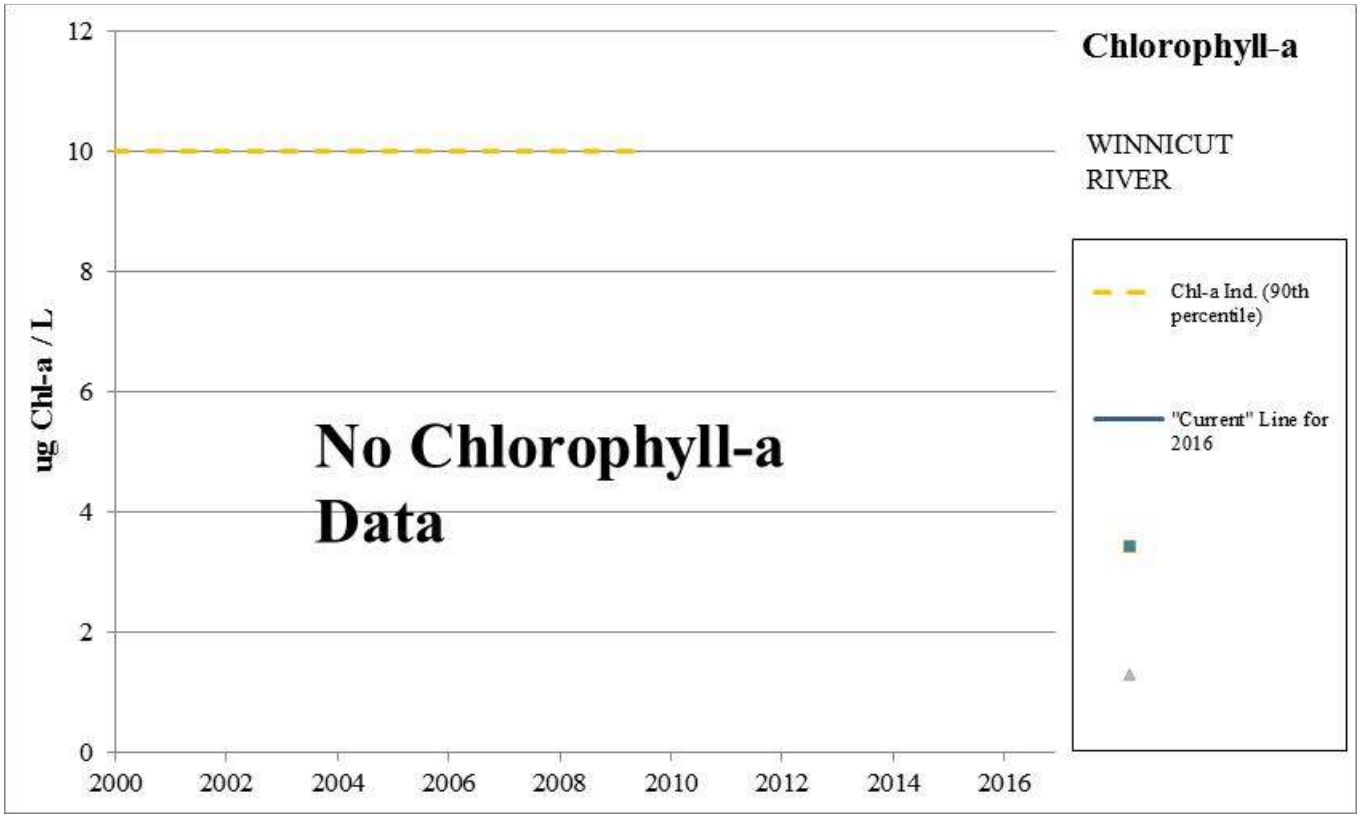


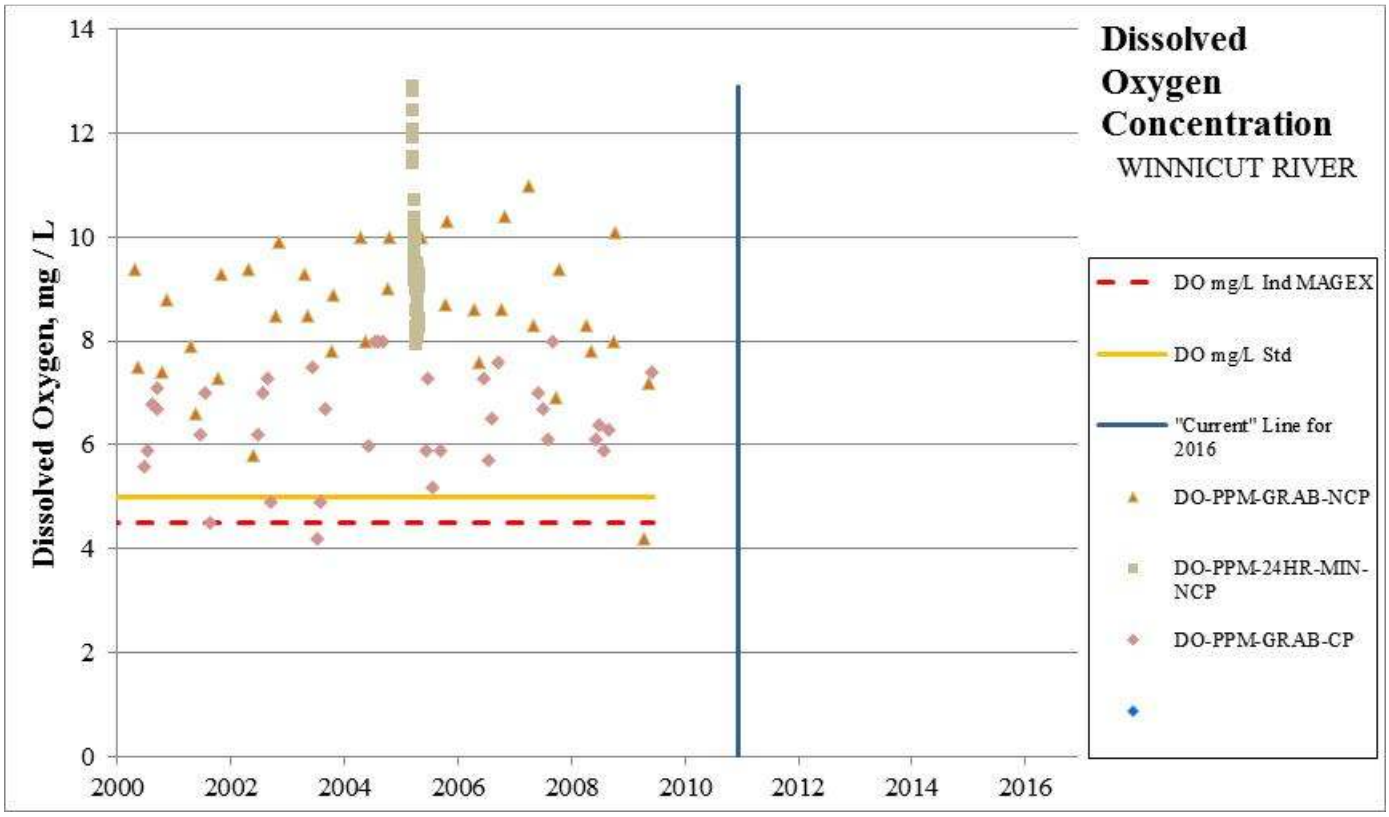
Lamprey River - South Assessment Zone	Count	Minimum	Median	90th Percentile	Maximum
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	0	-	-	-	-
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	0	-	-	-	-
CHLOROPHYLL A, combined	0	-	-	-	-
DO-PERC-24H-MEAN-CP	0	-	-	-	-
DO-PERC-24H-MEAN-NCP	0	-	-	-	-
DO-PERC-2TIDE-GRAB-CP	0	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP	0	-	-	-	-
DO-PPM-24HR-MIN-CP	0	-	-	-	-
DO-PPM-24HR-MIN-NCP	0	-	-	-	-
DO-PPM-GRAB-CP	0	-	-	-	-
DO-PPM-GRAB-NCP	0	-	-	-	-
LIGHT ATTENUATION COEFFICIENT	0	-	-	-	-
TURBIDITY	0	-	-	-	-
Day Ave of TN	0	-	-	-	-
Day Ave of TDN	0	-	-	-	-
Day Ave of DIN (NH3 + NO2/3)	0	-	-	-	-
Day Ave of NH3	1	250	250	-	250
Day Ave of PON	0	-	-	-	-
Day Ave of NO2/3	0	-	-	-	-

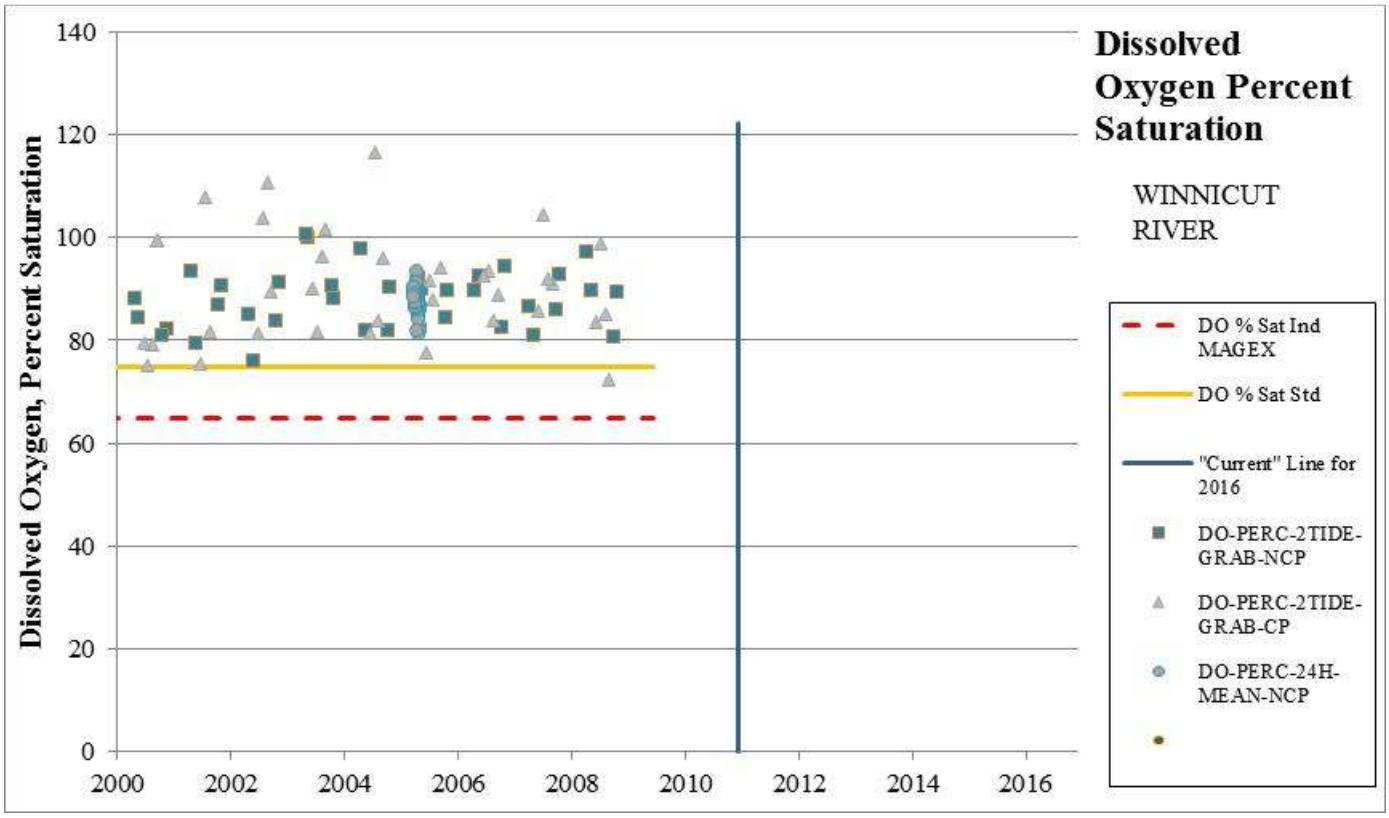
Assessment Zone = WINNICUT RIVER

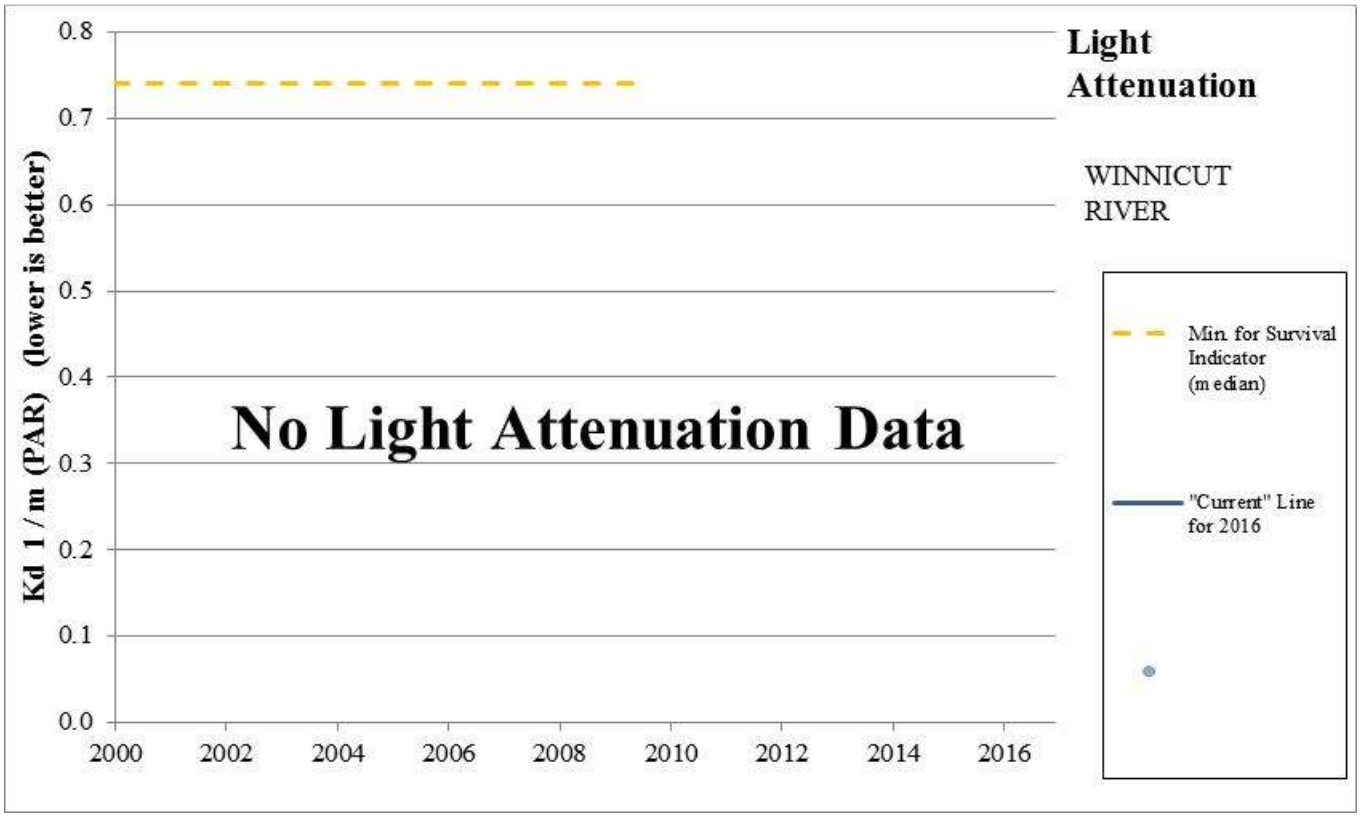
(NHEST600030904-01)

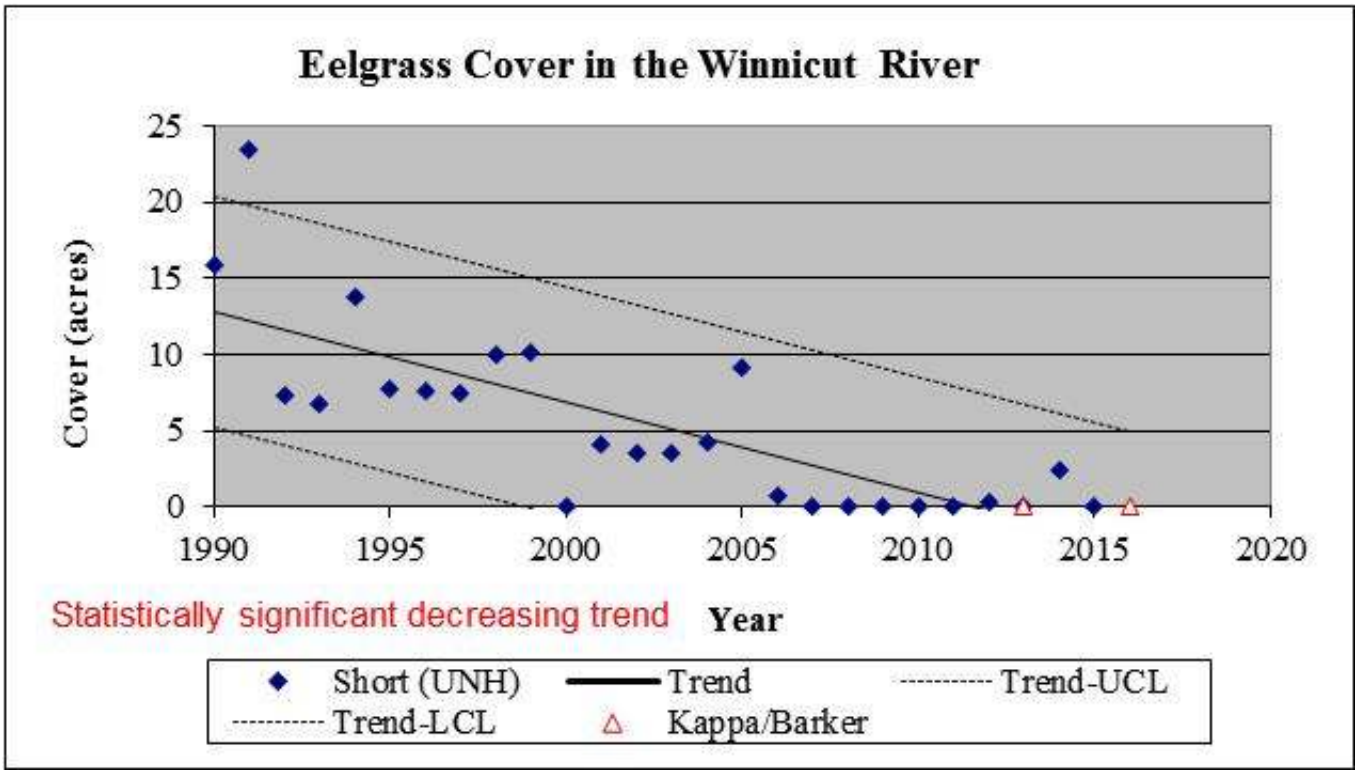
Indicator	Aquatic Life Use Category 2014 / 2016	2016 Comment
Chlorophyll-a	3-ND / 3-ND	The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. However, there is no chlorophyll-a data for this assessment zone.
Dissolved Oxygen (mg/L)	2-M / 3-ND	This assessment zone has no measurements for dissolved oxygen concentration since 2009. As such, this assessment zone has been assessed as 3-ND (No Data) dissolved oxygen concentration.
Dissolved Oxygen (% Saturation)	2-M / 3-ND	This assessment zone has no measurements for dissolved oxygen percent saturation since 2008. As such, this assessment zone has been assessed as 3-ND (No Data) for dissolved oxygen percent saturation.
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was not available from the 1948, 1962, 1980, and 1981 datasets. Eelgrass was present from 1990 through 2006. The median current extent of eelgrass in 2014-2016 is 0 acres. Since 1990, the trend in eelgrass cover in this assessment zone is a loss of 79.0%. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	3-ND / 3-ND	No data.
Total Nitrogen	3-ND / 3-ND	There are no “current” total nitrogen data from which to calculate a median total nitrogen from 2011 through 2015. As such, this assessment zone has been assessed as 3-ND (No Data) for total nitrogen.

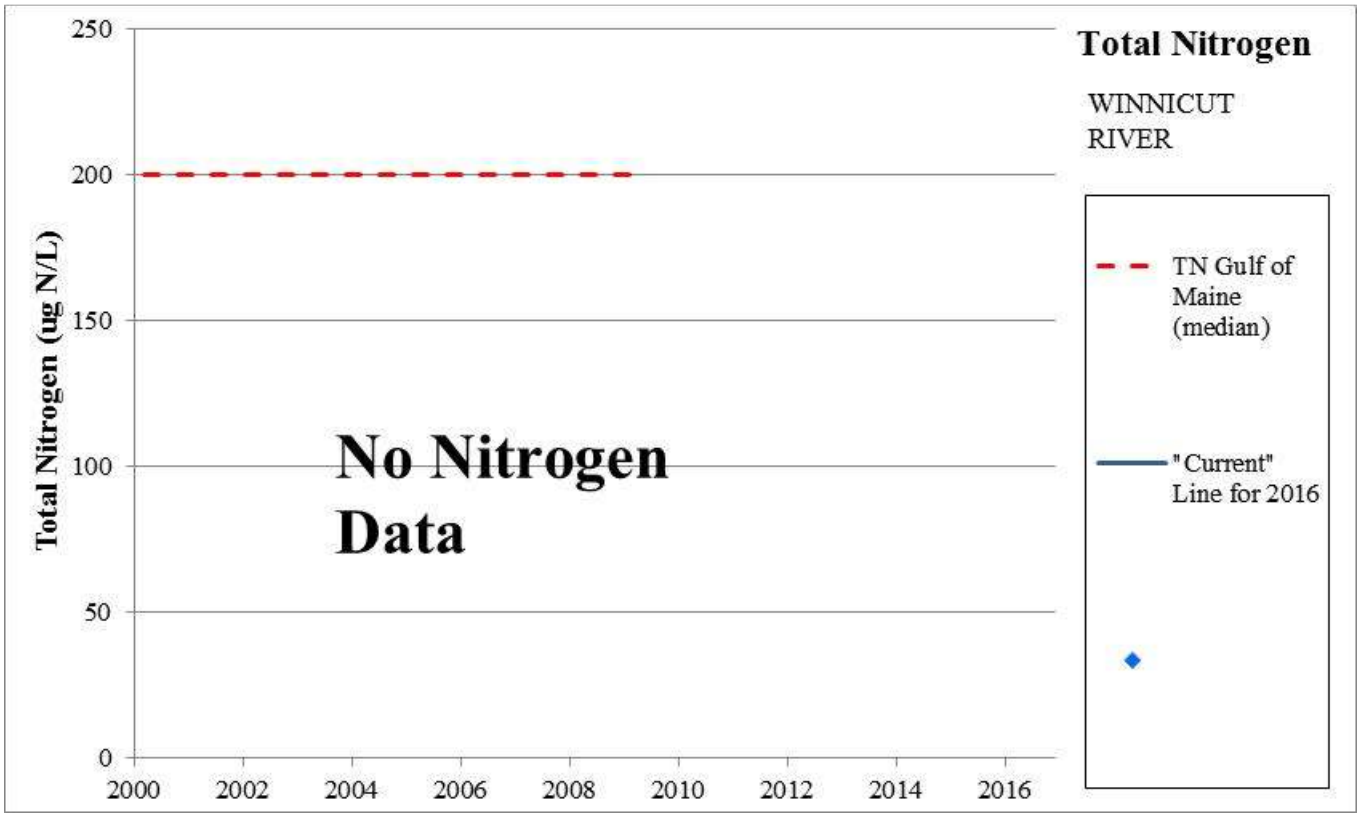



Dissolved Oxygen Concentration
WINNICUT RIVER
Dissolved Oxygen, mg / L
0
2
4
6
8
10
12
14
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2016
DO-PPM-GRAB-NCP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP


Dissolved Oxygen Percent Saturation
WINNICUT RIVER
Dissolved Oxygen, Percent Saturation
0
20
40
60
80
100
120
140
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2016
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP
DO-PERC-24H-MEAN-NCP


Light Attenuation
WINNICUT RIVER
Kd 1 / m (PAR) (lower is better)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
No Light Attenuation Data
Min. for Survival Indicator (median)
"Current" Line for 2016


Eelgrass Cover in the Winnicut River
Cover (acres)
25
20
15
10
5
0
1990
1995
2000
2005
2010
2015
2020
Statistically significant decreasing trend
Year
Short (UNH)
Trend
Trend-UCL
Trend-LCL
Kappa/Barker


Total Nitrogen
WINNICUT RIVER
Total Nitrogen (ug N/L)
250
200
150
100
50
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
No Nitrogen Data
TN Gulf of Maine (median)
"Current" Line for 2016

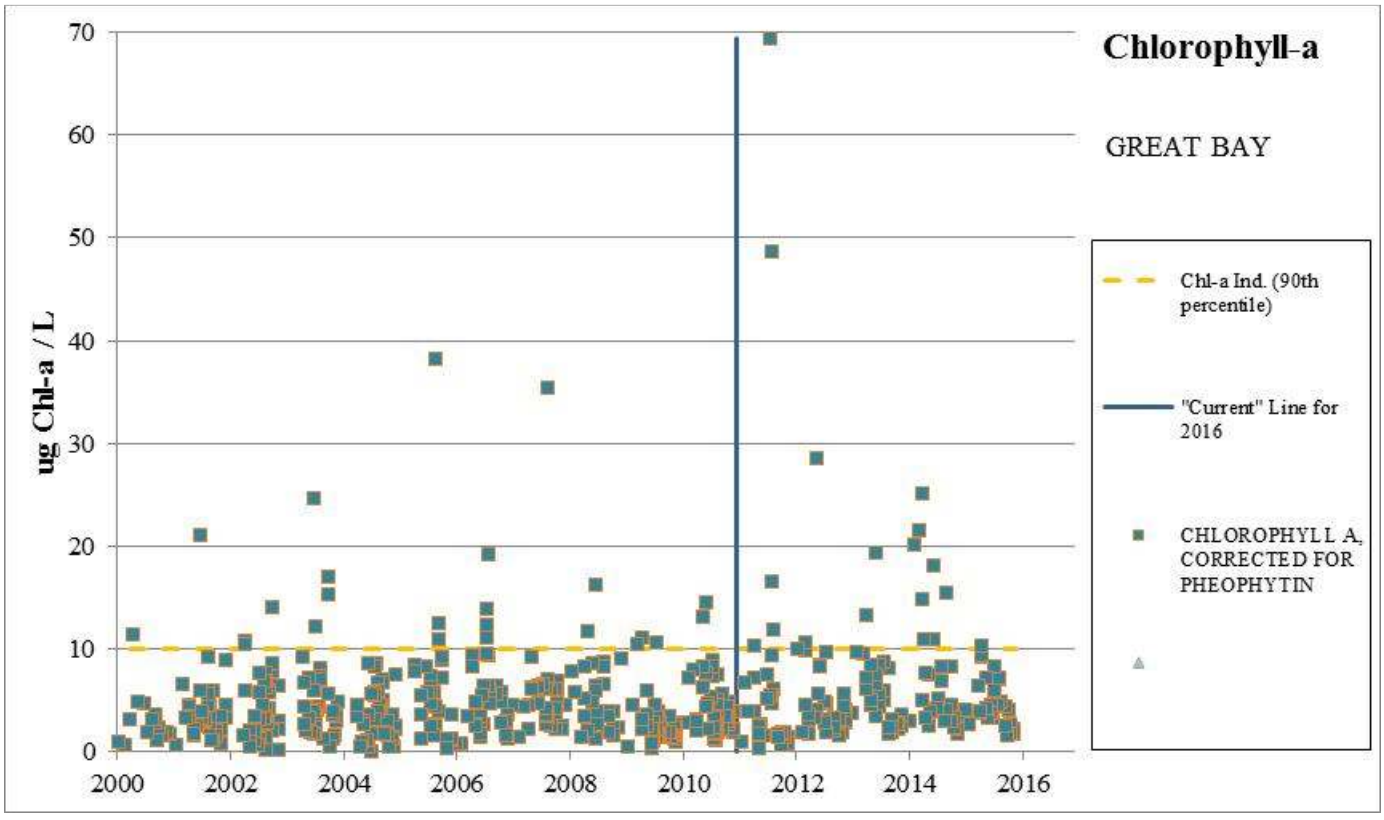
Winnicut River Assessment Zone	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	0	-	-	-	-
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	0	-	-	-	-
CHLOROPHYLL A, combined	0	-	-	-	-
DO-PERC-24H-MEAN-CP	0	-	-	-	-
DO-PERC-24H-MEAN-NCP	0	-	-	-	-
DO-PERC-2TIDE-GRAB-CP	0	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP	0	-	-	-	-
DO-PPM-24HR-MIN-CP	0	-	-	-	-
DO-PPM-24HR-MIN-NCP	0	-	-	-	-
DO-PPM-GRAB-CP	0	-	-	-	-
DO-PPM-GRAB-NCP	0	-	-	-	-
LIGHT ATTENUATION COEFFICIENT	0	-	-	-	-
TURBIDITY	0	-	-	-	-
Day Ave of TN	0	-	-	-	-
Day Ave of TDN	0	-	-	-	-
Day Ave of DIN (NH3 + NO2/3)	0	-	-	-	-
Day Ave of NH3	0	-	-	-	-
Day Ave of PON	0	-	-	-	-
Day Ave of NO2/3	0	-	-	-	-

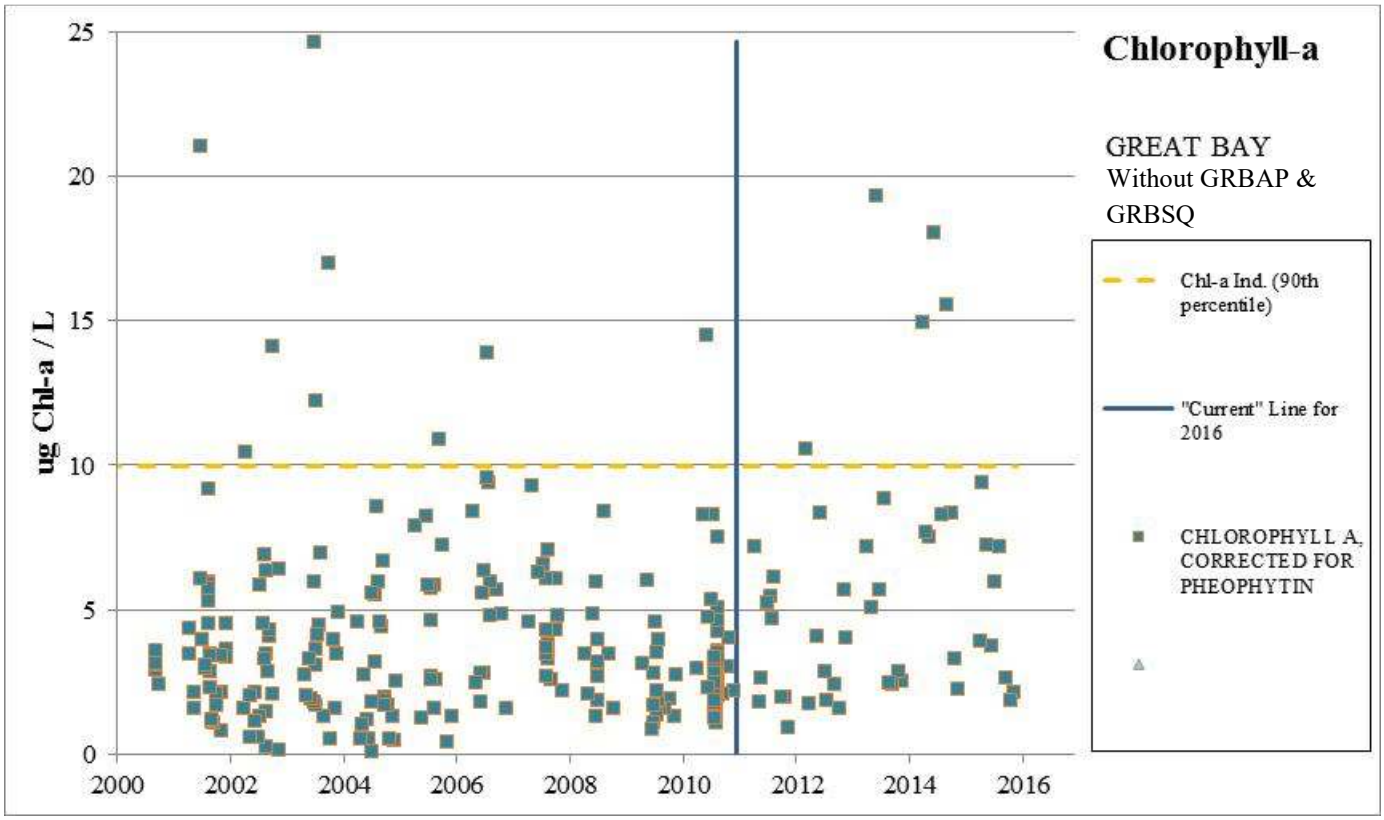
Assessment Zone = GREAT BAY

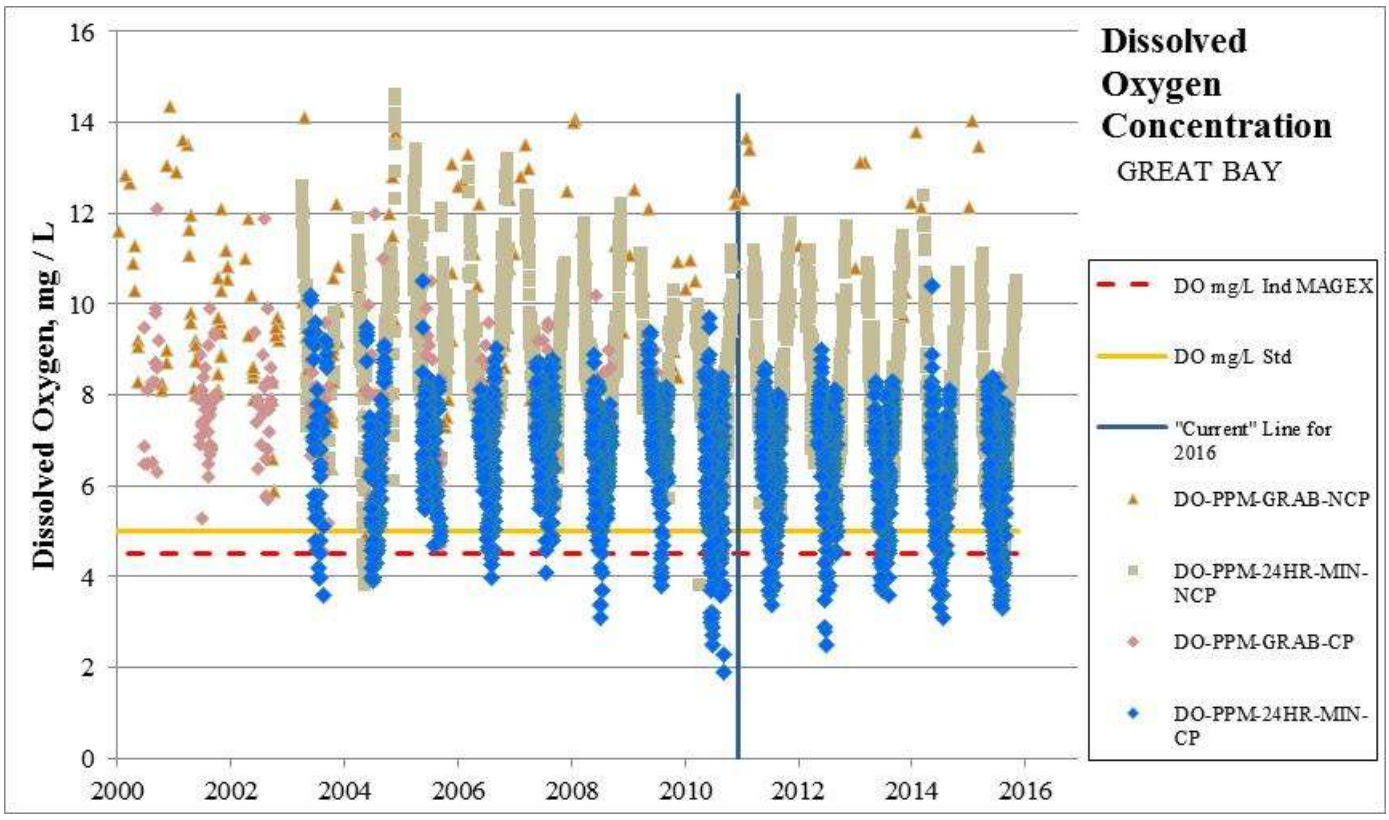
(NHEST600030904-02, NHEST600030904-03, NHEST600030904-04-02, NHEST600030904-04-03, NHEST600030904-04-04, NHEST600030904-04-05, NHEST600030904-04-06)

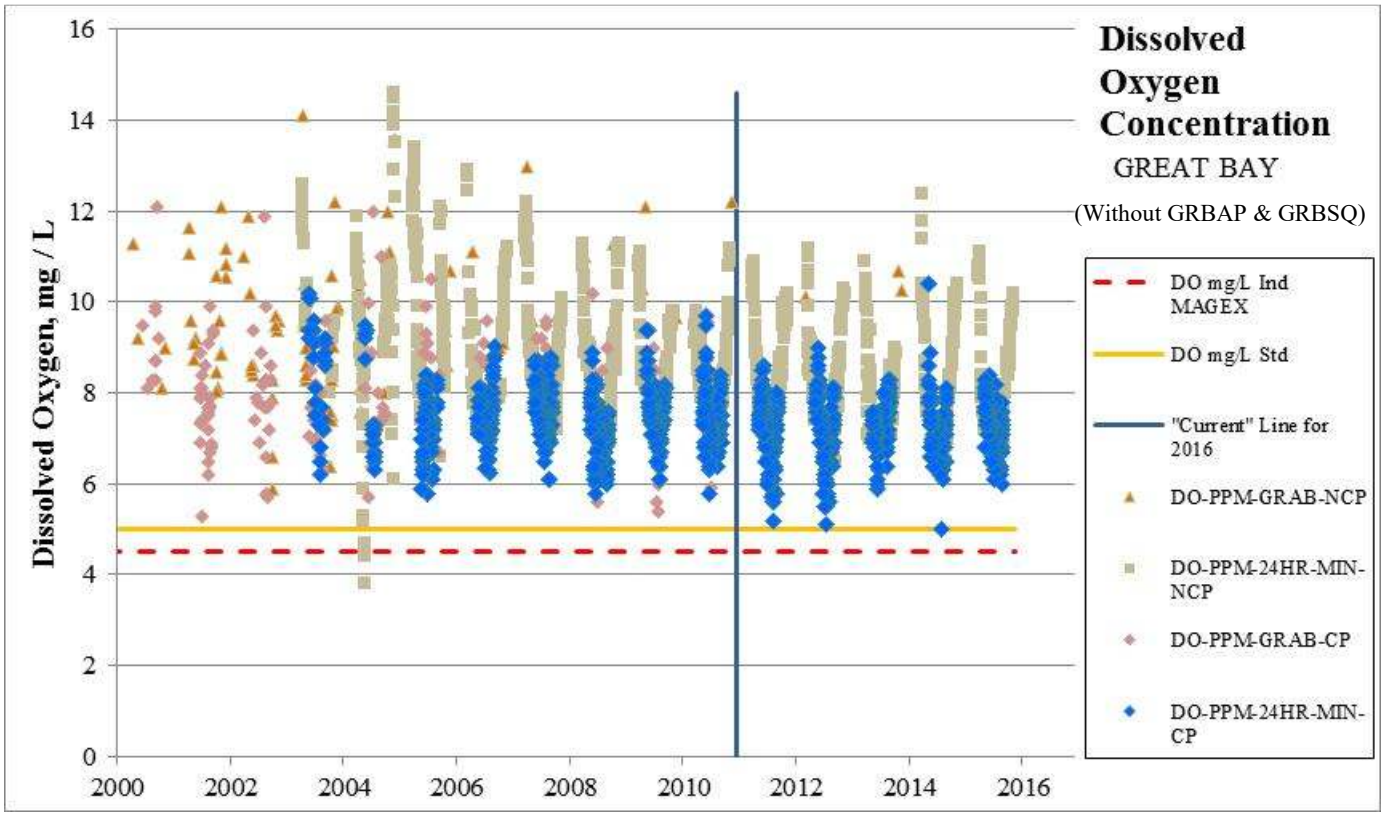
Indicator	Aquatic Life Use Category 2014 / 2016	2016 Comment
Chlorophyll-a	2-M / 3-PNS	The calculated 90th percentile for chlorophyll-a in this assessment zone is 10.7 ug/L (n = 155) [11.5 ug/L (n=47) without GRBAP and GRBSQ]. The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. It would be very valuable to deploy a continuous chlorophyll probe to determine if the grab samples are representative of the full chlorophyll data distribution. As chlorophyll-a is now close to the assessment threshold chlorophyll-a has been assessed as Insufficient Information – Potentially Not Supporting.
Dissolved Oxygen (mg/L)	3-PNS / 3-PNS	This assessment zone has 24 hour datalogger and grab measurements for dissolved oxygen concentration. One of the assigned stations (GRBSQ - Squamscott River datasonde at RR bridge) is at the mouth of the Squamscott River, precisely at the divide between the Squamscott River and Great Bay assessment zones. The very low readings from GRBSQ are a cause for concern. While GRBSQ more accurately represents the conditions in the Squamscott River than the entirety of Great Bay proper, it indicates that low DO issues are likely to extend into portions of Great Bay. The primary sampled station (GRBGB) inside of the Great Bay assessment zone also shows marginal dissolved oxygen samples 0.5 meters off the bottom including concentrations in 2011 and 2012 dipping below 5.5 mg/L. Considering all the data across the assessment zone, conditions warrant retention of the dissolved oxygen concentration assessment as Insufficient Information – Potentially Not Supporting.
Dissolved Oxygen (% Saturation)	2-M / 2-M	This assessment zone has 24 hour datalogger and grab measurements for dissolved oxygen percent saturation. One of the assigned stations (GRBSQ - Squamscott River datasonde at RR bridge) is at the mouth of the Squamscott River, precisely at the divide between the Squamscott River and Great Bay assessment zones. While GRBSQ more accurately represents the conditions in the Squamscott River than the entirety of Great Bay proper, it does indicate low DO issues are likely to extend into portions of Great Bay. The primary sampled station (GRBGB) inside of the Great Bay assessment zone also shows acceptable dissolved oxygen saturation 0.5 meters off the bottom. These marginally low readings from GRBSQ are not severe enough at this time to warrant removal of the full support assessment for dissolved oxygen percent saturation.
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 2,130.7 acres from the 1948, 1962, 1980, and 1981 datasets. The median current extent of eelgrass in 2013-2016 is 1464 acres, which is a 31% decrease. Since 1990, the trend in eelgrass cover in this assessment zone is a loss of 26.4%. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	5-M / 5-M	Median=1.5 m^-1 (n=128). For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1. This assessment zone historically had eelgrass growing in both the shallows and deeper habitat making the 2m restoration depth a valid target. Therefore, the impaired (5-M) listing from the 2014 303d list has been retained.
Total Nitrogen	3-PNS / 3-PNS	The median total nitrogen from 2011 through 2015 was 337 ug/L (n=45) when considering only the stations in the middle of Great Bay; and 387 ug/L (n=149) when including the boundary stations GRBSQ and GRBAP. In neither case is there a statistically significant trend in total nitrogen over the 2003 to 2015 time period. This assessment zone has no demonstrated dissolved oxygen exceedences at station GRBGB in the middle of Great Bay. However, when considering all sampling stations of Great Bay there are areas in the southwest that likely exhibit poor dissolved oxygen. Likewise, the calculated 90th percentile chlorophyll-a in this assessment zone is 10.7 ug/L (n = 155), which is just above the threshold described in the CALM but dissolved oxygen problems are not evident in the main part of the Great Bay. Chlorophyll-a experiences peak concentrations annually from 10-69 ug/L in the south western area. The eelgrass beds are degraded and the available light attenuation (median=1.5 m^-1 (n=128)) is poor. For shallow systems, it is expected

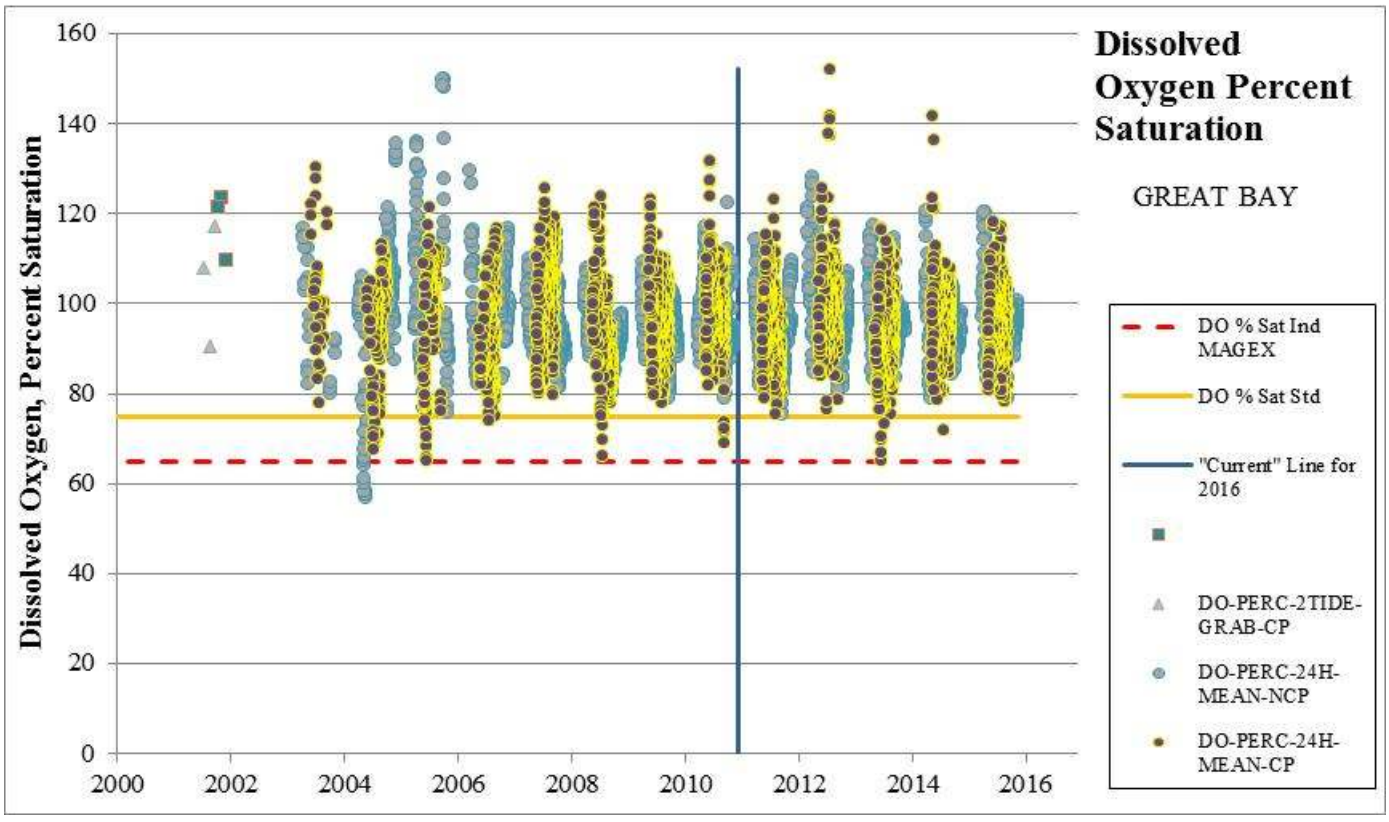
		that changes in macroalgae will precede changes in phytoplankton (McGlathery, Sundbäck, & Anderson, 2007) (Valiela, et al., 1997), as appears to be occurring in the Great Bay assessment zone. There is evidence that macroalgae is impacting eelgrass and changing the species composition and diversity in Great Bay to some extent. Using data from Great Bay (Pe'eri, Morrison, Short, Mathieson, Brook, & Trowbridge, 2008), NHDES determined that macroalgae mats had replaced nearly 5.7% of the area formerly occupied by eelgrass in Great Bay in 2007 (NHDES, 2009) and that replaced area has not been recolonized by eelgrass. Some of the loss of eelgrass in the intertidal zone is consistent with smothering by macroalgae. The foremost authority on macroalgae for this estuary, Dr. Arthur C. Mathieson, commented on the draft 2012 303(d) that he remains concerned about the macroalgae and epiphyte conditions in Great Bay Bay (NHDES, 2013). Burdick et al. (2016) note that, "Monitoring results from 2014 show high levels of cover of nuisance green and red algae (*Ulva* and *Gracilaria*, respectively) at all sites except near the mouth of the Estuary." The Burdick et al. (Burdick, Mathieson, Peter, & Sydney, 2016) study included several sites within Great Bay. Some of the classic indicators of nutrient eutrophication are present in this assessment zone and total nitrogen remains elevated in portions of the assessment zone. As the discussion above illustrates, there is a clear nutrient "signature" in the data. It is less clear, at this time, whether the response datasets demonstrate sufficient power to determine that the eutrophication effects on designated uses can be attributed to total nitrogen alone. Given that uncertainty, impairment is not warranted under New Hampshire's narrative standard. As such, this assessment zone has been assessed as Insufficient Information – Potentially Not Supporting (3-PNS) for total nitrogen.

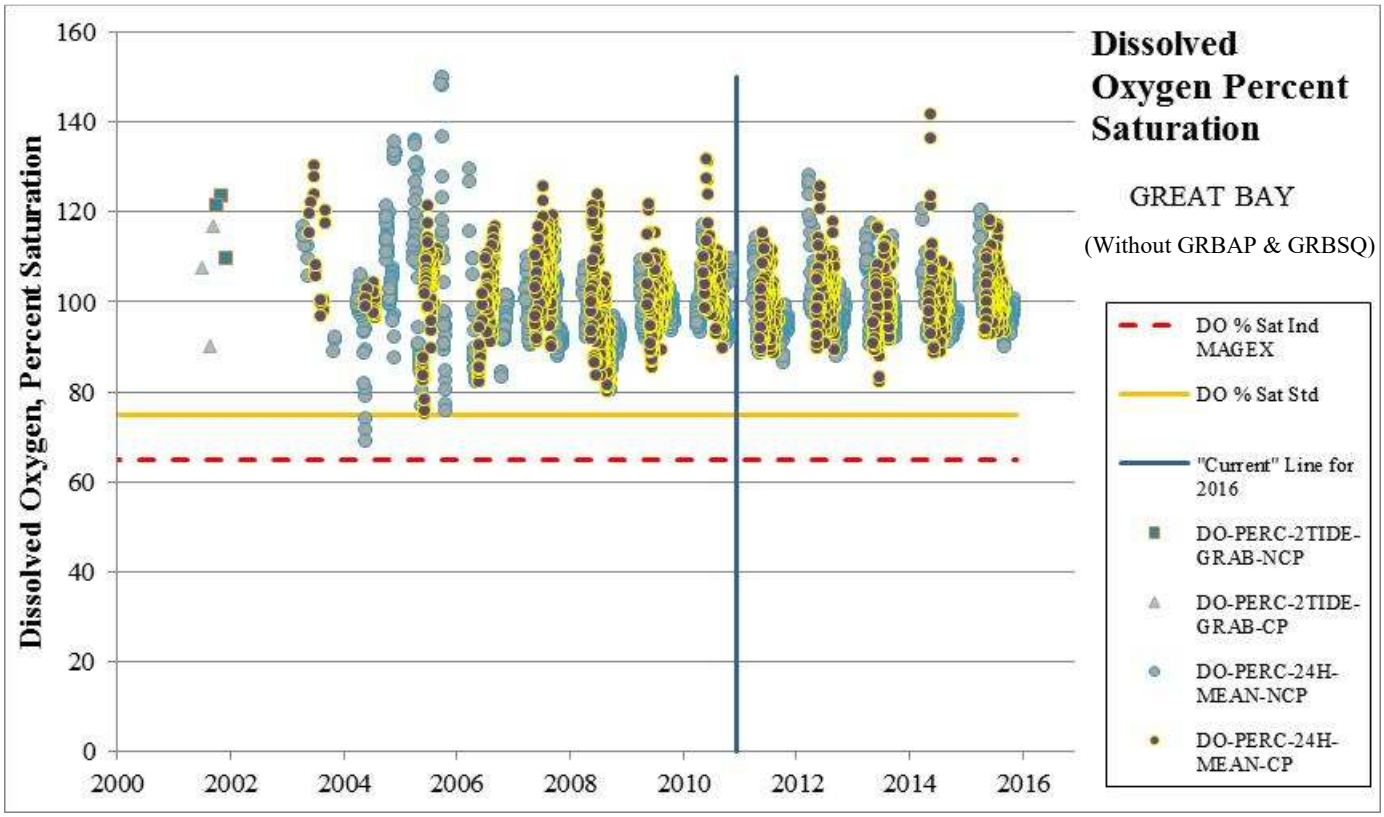


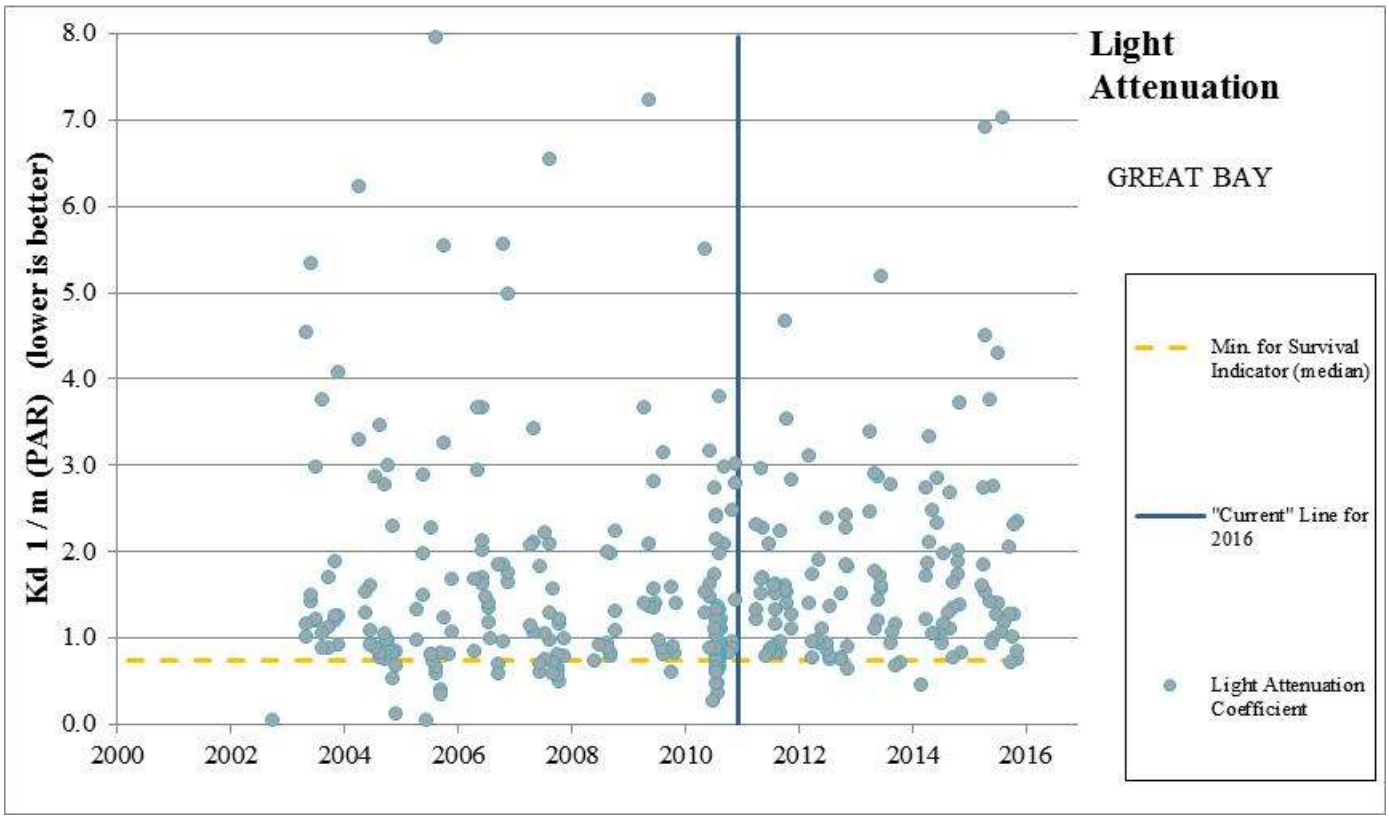

Chlorophyll-a
GREAT BAY
Without GRBAP & GRBSQ
ug Chl-a / L
25
20
15
10
5
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
Chl-a Ind. (90th percentile)
"Current" Line for 2016
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN

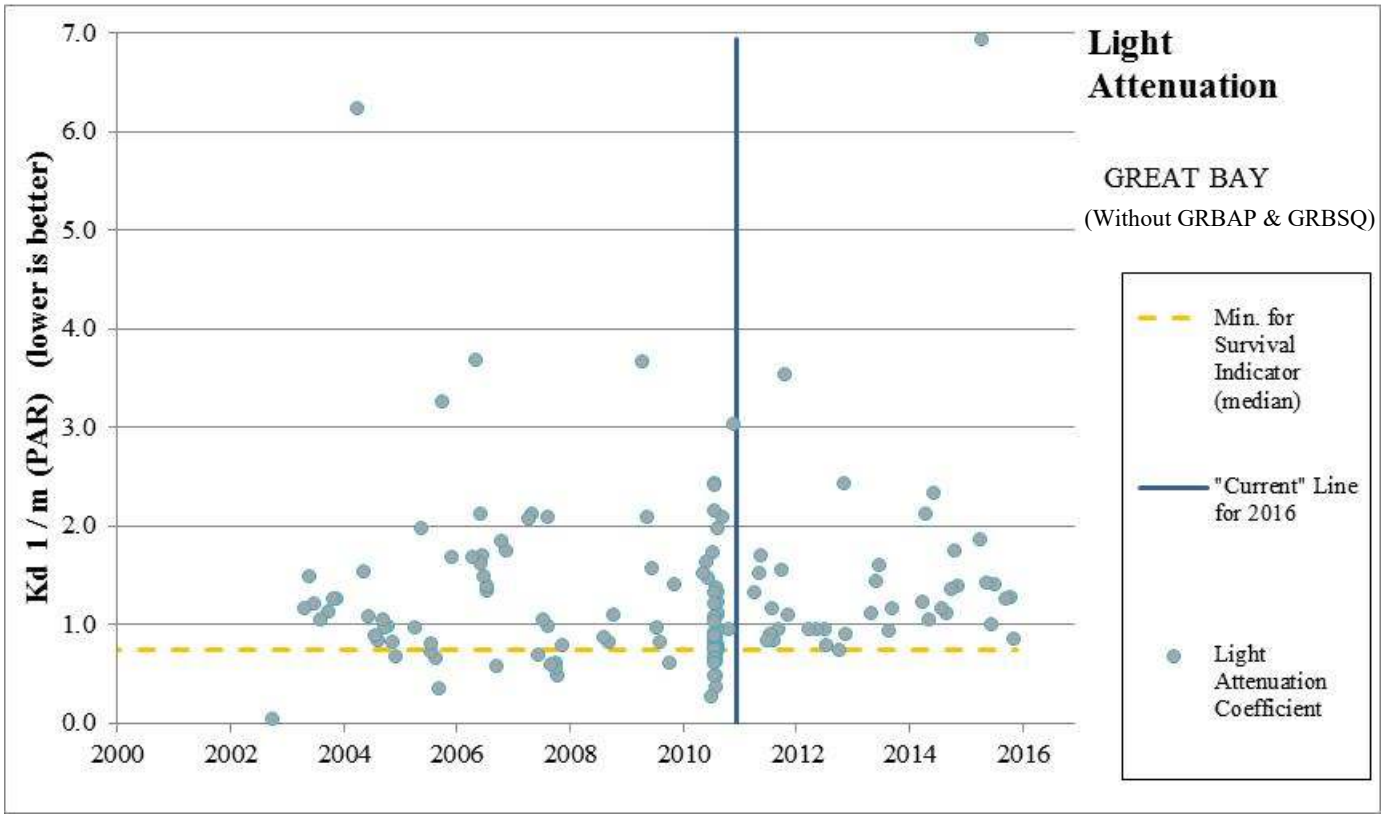

Dissolved Oxygen Concentration
GREAT BAY
Dissolved Oxygen, mg / L
16
14
12
10
8
6
4
2
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2016
DO-PPM-GRAB-NCP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-24HR-MIN-CP

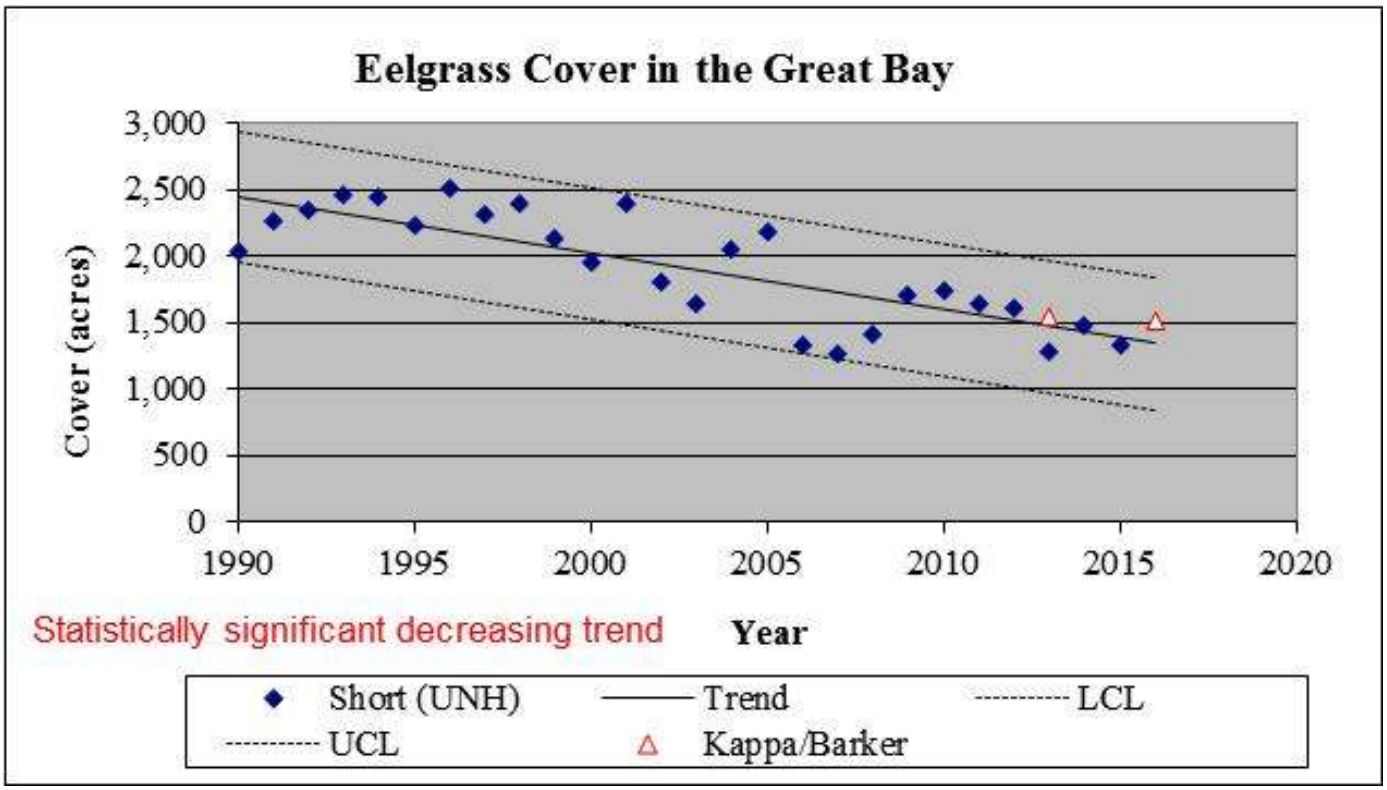

Dissolved Oxygen Concentration
GREAT BAY
(Without GRBAP & GRBSQ)
Dissolved Oxygen, mg / L
16
14
12
10
8
6
4
2
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2016
DO-PPM-GRAB-NCP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-24HR-MIN-CP

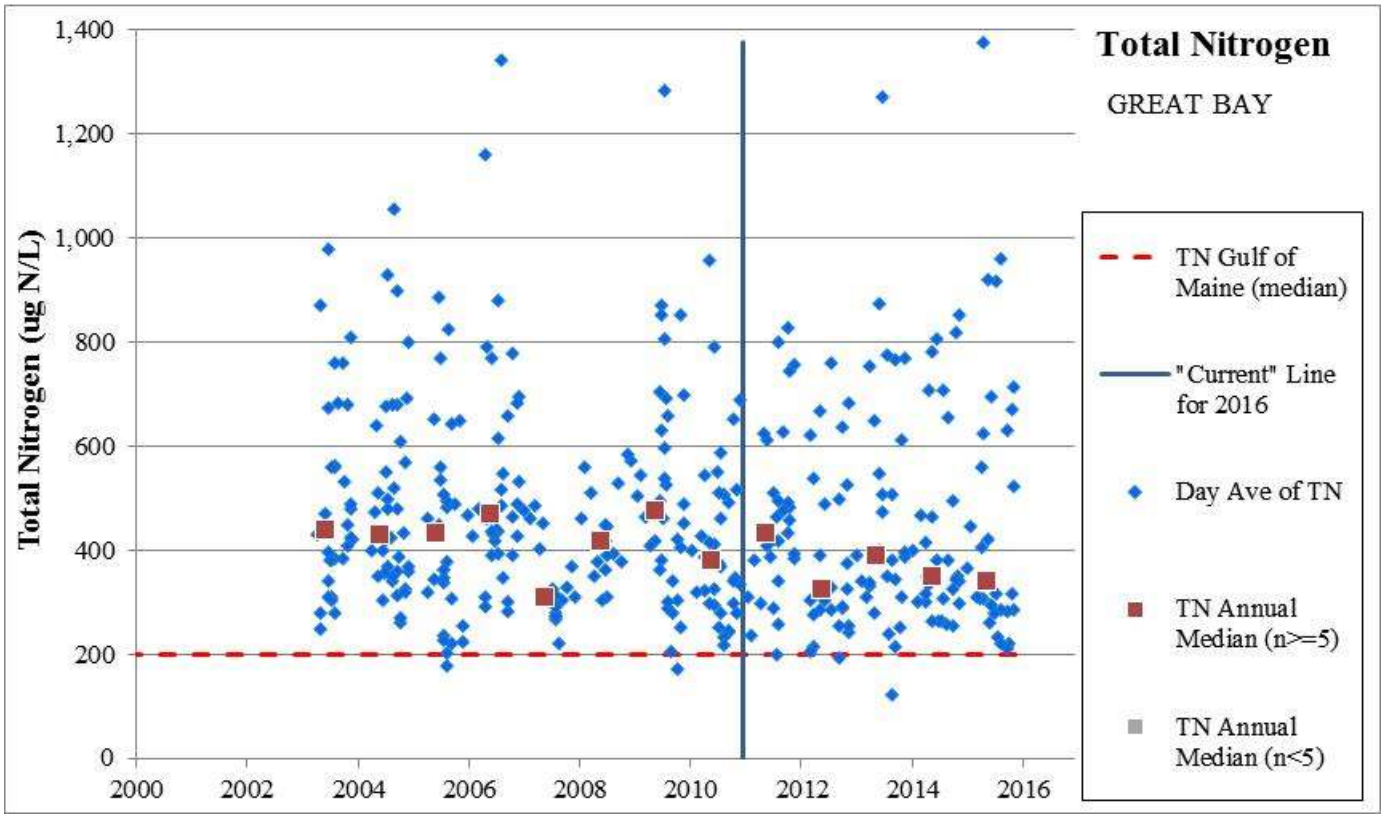

Dissolved Oxygen Percent Saturation
GREAT BAY
Dissolved Oxygen, Percent Saturation
160
140
120
100
80
60
40
20
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2016
DO-PERC-2TIDE-GRAB-CP
DO-PERC-24H-MEAN-NCP
DO-PERC-24H-MEAN-CP

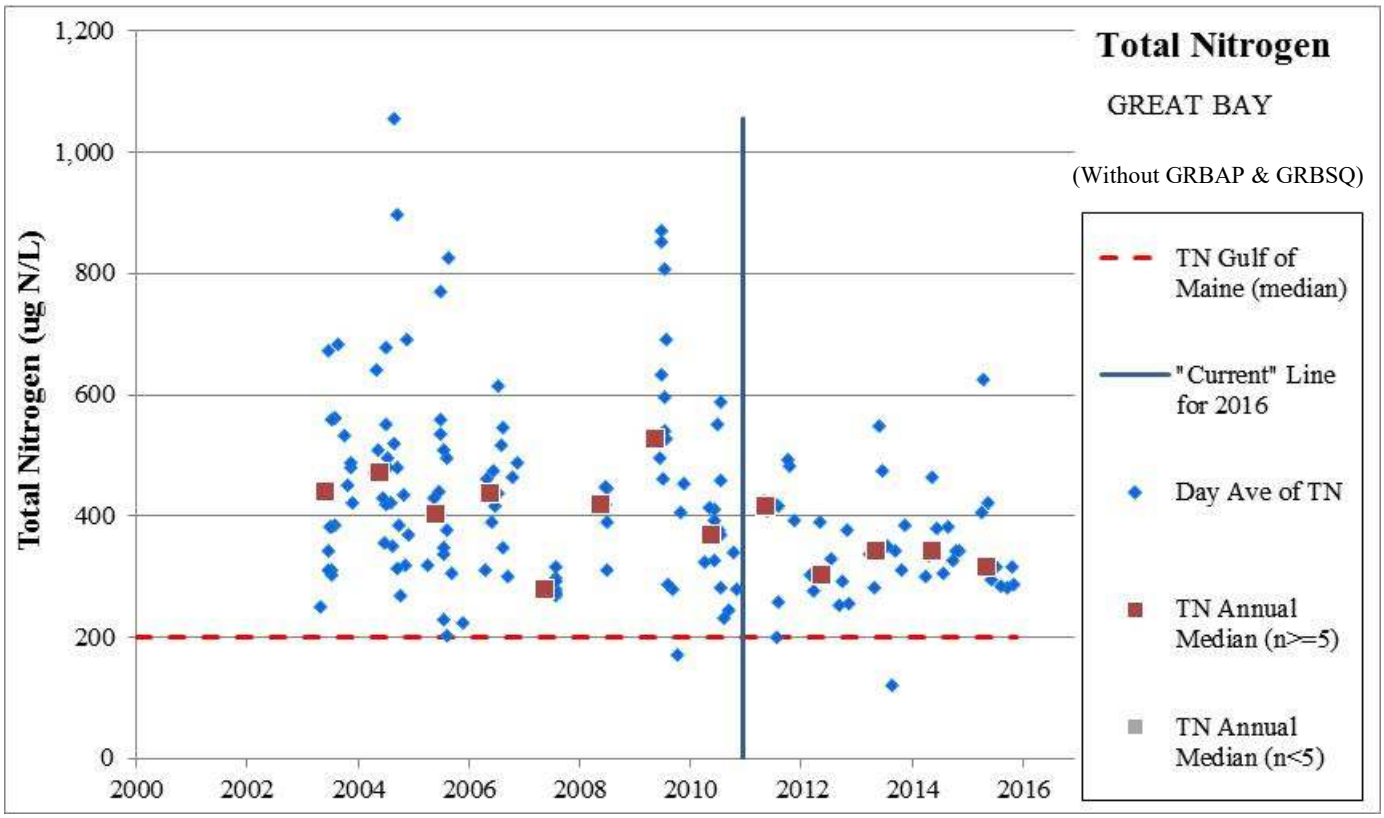

Dissolved Oxygen Percent Saturation
GREAT BAY
(Without GRBAP & GRBSQ)
Dissolved Oxygen, Percent Saturation
160
140
120
100
80
60
40
20
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2016
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP
DO-PERC-24H-MEAN-NCP
DO-PERC-24H-MEAN-CP


Light Attenuation
GREAT BAY
Kd 1 / m (PAR) (lower is better)
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
Min. for Survival Indicator (median)
"Current" Line for 2016
Light Attenuation Coefficient


Light Attenuation
GREAT BAY
(Without GRBAP & GRBSQ)
Kd 1 / m (PAR) (lower is better)
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
Min. for Survival Indicator (median)
"Current" Line for 2016
Light Attenuation Coefficient


Eelgrass Cover in the Great Bay
Cover (acres)
3,000
2,500
2,000
1,500
1,000
500
0
1990
1995
2000
2005
2010
2015
2020
Statistically significant decreasing trend
Year
Short (UNH)
Trend
LCL
UCL
Kappa/Barker


Total Nitrogen
GREAT BAY
Total Nitrogen (ug N/L)
1,400
1,200
1,000
800
600
400
200
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
TN Gulf of Maine (median)
"Current" Line for 2016
Day Ave of TN
TN Annual Median (n>=5)
TN Annual Median (n<5)

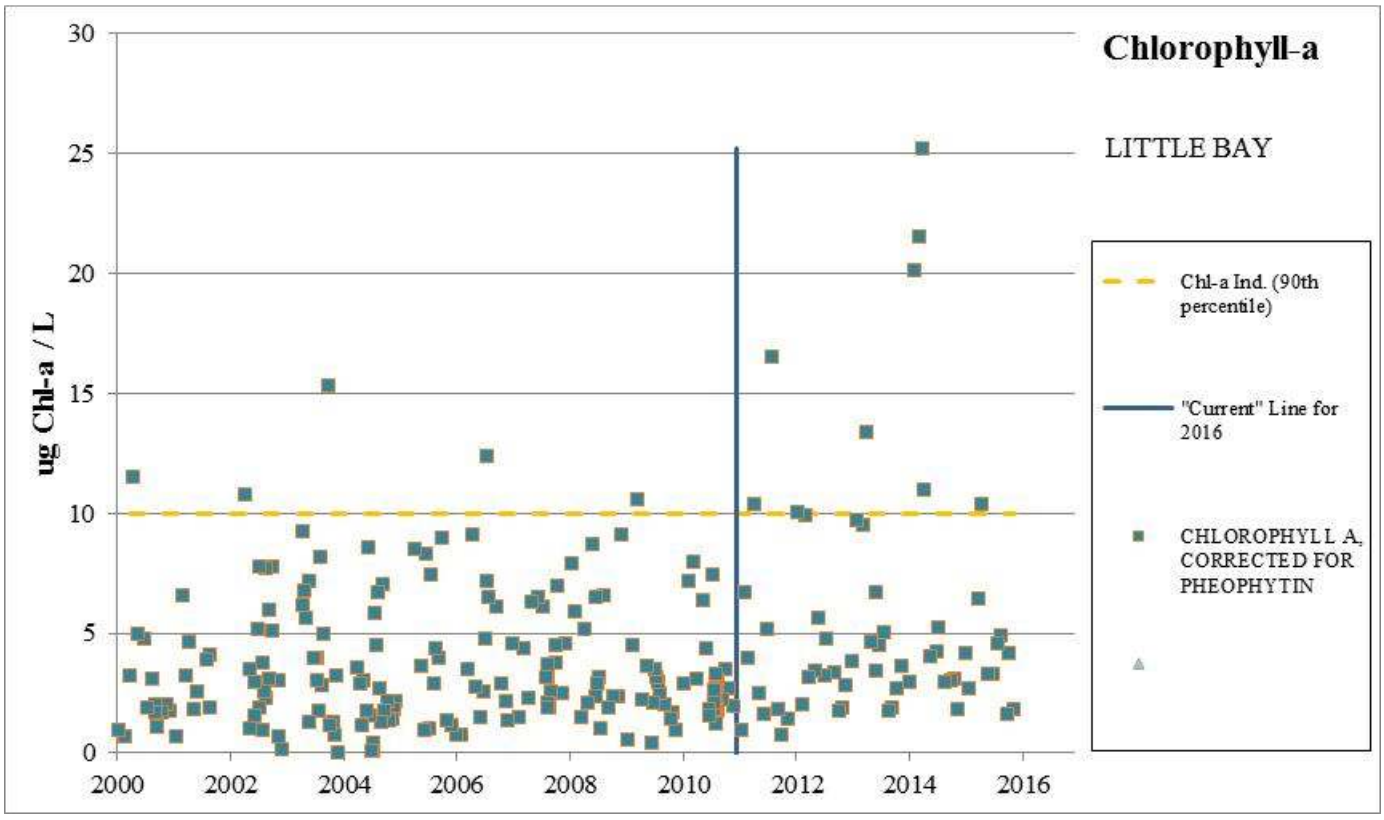

Total Nitrogen
GREAT BAY
(Without GRBAP & GRBSQ)
Total Nitrogen (ug N/L)
1,200
1,000
800
600
400
200
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
TN Gulf of Maine (median)
"Current" Line for 2016
Day Ave of TN
TN Annual Median (n>=5)
TN Annual Median (n<5)

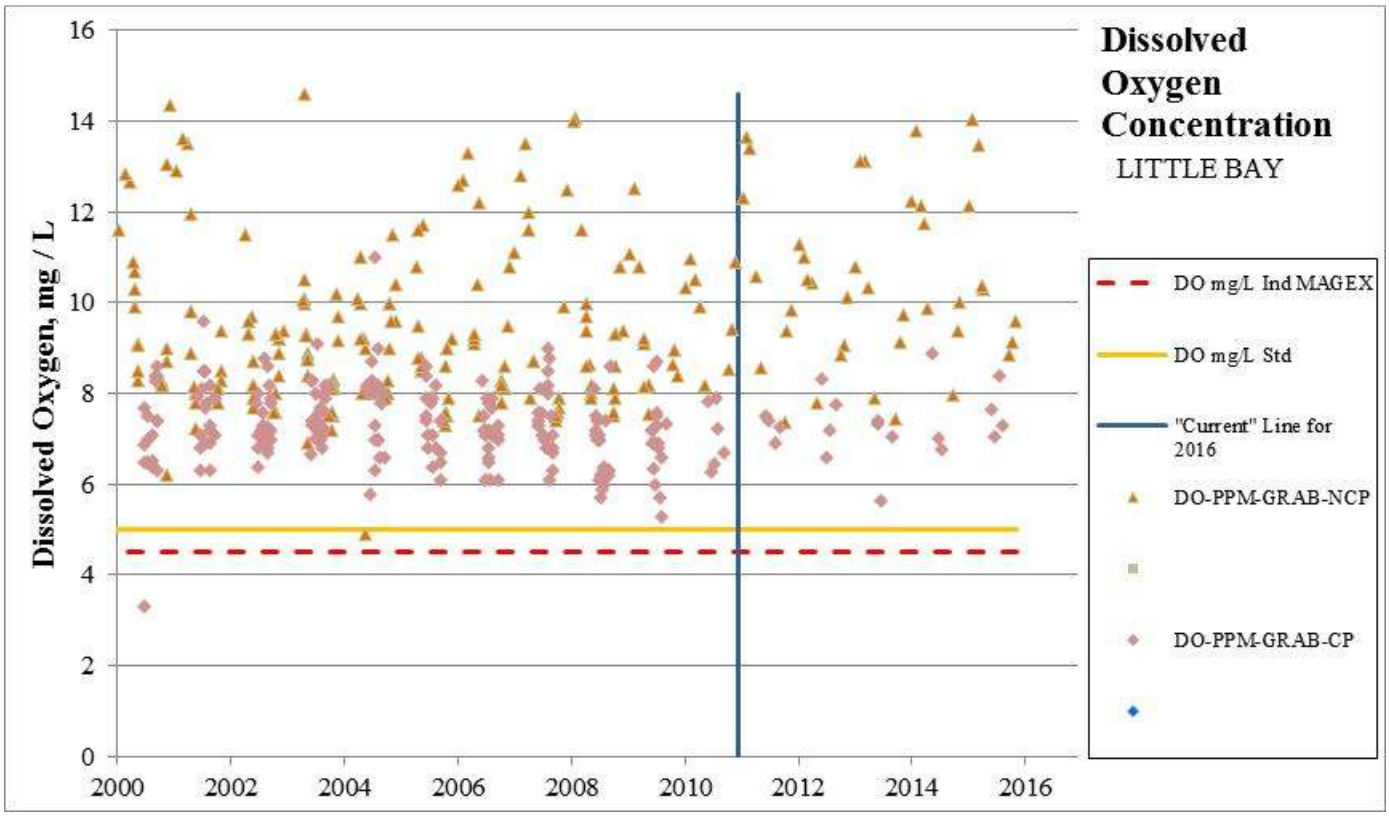
Great Bay Assessment Zone	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	155	0.4	4.2	**10.7**	69.4
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	0	-	-	**-**	-
CHLOROPHYLL A, combined	155	0.0	4.2	10.7	69.4
DO-PERC-24H-MEAN-CP	1,085	65.4	96.7	108.0	152.0
DO-PERC-24H-MEAN-NCP	1,051	75.7	95.9	105.8	128.4
DO-PERC-2TIDE-GRAB-CP	2	92.6	98.6	-	104.5
DO-PERC-2TIDE-GRAB-NCP	0	-	-	**-**	-
DO-PPM-24HR-MIN-CP	1,122	2.5	6.6	7.8	10.4
DO-PPM-24HR-MIN-NCP	1,081	4.7	8.6	10.5	12.4
DO-PPM-GRAB-CP	21	5.7	7.3	8.4	8.9
DO-PPM-GRAB-NCP	43	7.4	10.3	13.4	14.0
LIGHT ATTENUATION COEFFICIENT	128	0.480	**1.495**	2.994	7.050
TURBIDITY	2,151	0.0	9.0	41.0	2,630.0
Day Ave of TN	149	122	**387**	765	1,376
Day Ave of TDN	157	50	281	607	896
Day Ave of DIN (NH3 + NO2/3)	157	5	129	380	594
Day Ave of NH3	157	3	41	198	408
Day Ave of PON	2	168	172	-	177
Day Ave of NO2/3	157	3	79	178	299

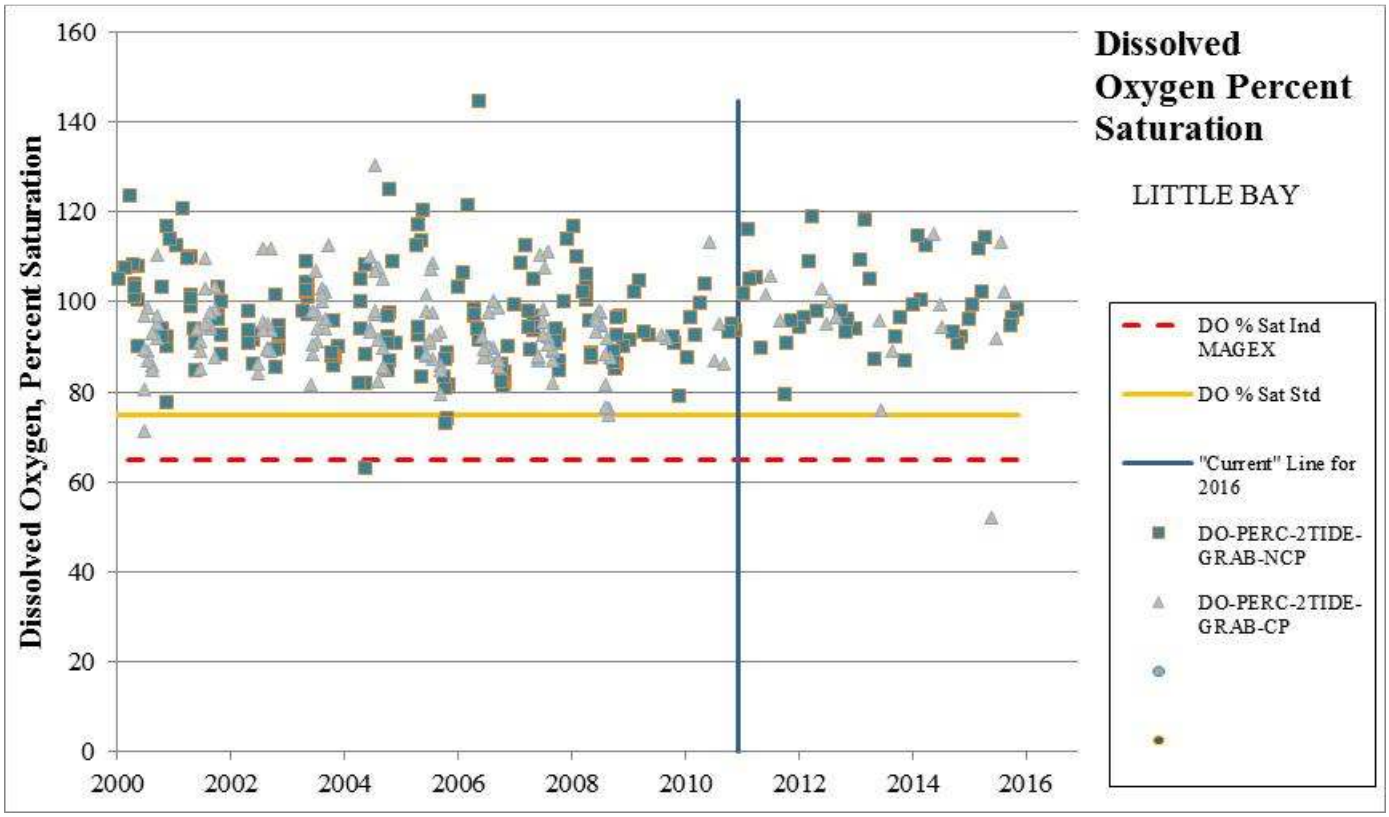
Assessment Zone = LITTLE BAY

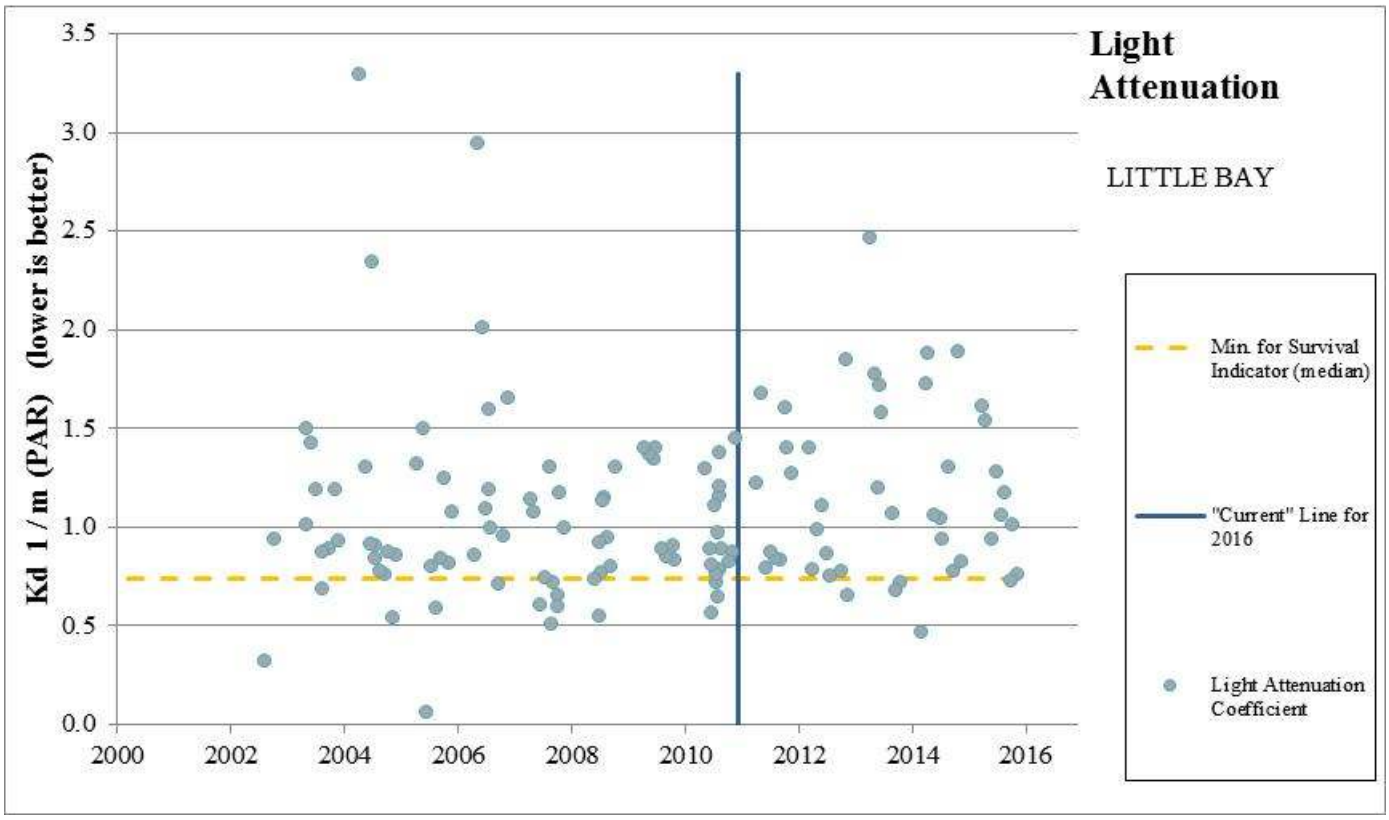
(NHEST600030904-06-10, NHEST600030904-06-11, NHEST600030904-06-12, NHEST600030904-06-14, NHEST600030904-06-15, NHEST600030904-06-18, NHEST600030904-06-19)

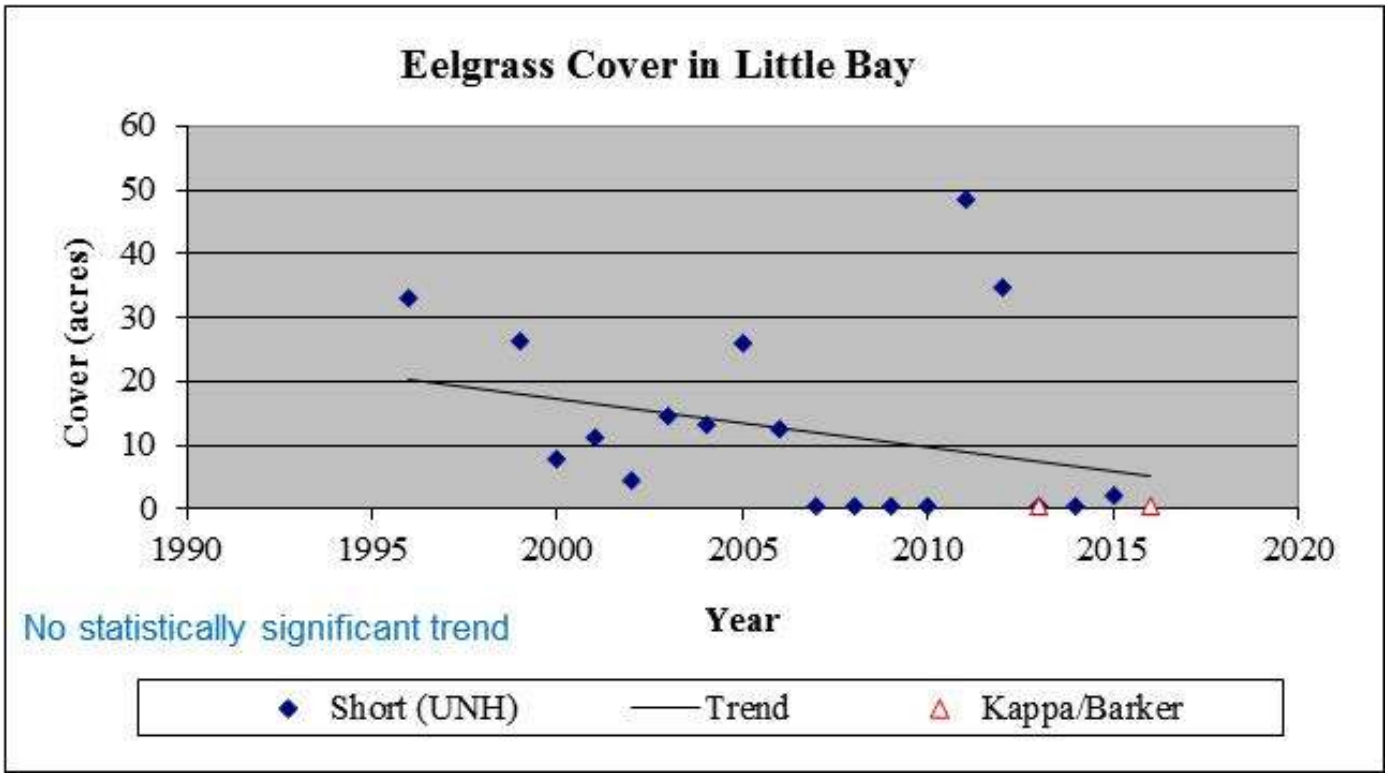
Indicator	Aquatic Life Use Category 2014 / 2016	2016 Comment
Chlorophyll-a	2-M / 3-PNS	The calculated 90th percentile chlorophyll-a in this assessment zone is 11.0 ug/L (n = 59) and a maximum reading of 25.2 ug/L. The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. As chlorophyll-a is now close to the assessment threshold chlorophyll-a has been assessed as Insufficient Information – Potentially Not Supporting.
Dissolved Oxygen (mg/L)	2-G / 2-G	This assessment zone does not have a datalogger, so only surface (0.5m below surface) grab sample measurements (GRBAP) for dissolved oxygen concentration and those measurements have been collected from 2011 through 2015. The available data indicates that this assessment zone meets the dissolved oxygen concentration criteria.
Dissolved Oxygen (% Saturation)	2-M / 2-G	This assessment zone does not have a datalogger, so only high-tide/low-tide paired surface (0.5m below surface) grab sample measurements (GRBAP) can be used to evaluate against the dissolved oxygen 24 hour average percent saturation criteria. Those measurements have been collected from 2011 through 2015 and there were occasional grab samples at or below 75 percent. The weight of the available data indicates that this assessment zone meets the dissolved oxygen percent saturation criteria.
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 252 acres from the 1948, 1962, 1980, and 1981 datasets. The median current extent of eelgrass in 2014-2016 is 0 acres, which is a decrease of 100%. There is no significant trend in eelgrass cover in this assessment zone since 1990. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	5-M / 5-M	Median=1.075 m^-1 (n=45). For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1. This assessment zone historically had eelgrass growing in both the shallows and deeper habitat making the 2m restoration depth a valid target. Therefore, the impaired (5-M) listing from the 2014 303d list has been retained.
Total Nitrogen	3-PNS / 3-PNS	The median total nitrogen from 2011 through 2015 was 310 ug/L (n=58). There is not a statistically significant trend in total nitrogen over the 2003 to 2015 time period. Based exclusively on grab samples, the measurements in this assessment zone do not demonstrate dissolved oxygen concentration exceedences and there were only occasional grab samples at or below 75 percent saturation. The calculated 90th percentile chlorophyll-a in this assessment zone is 11.0 ug/L (n = 59) and a maximum reading of 25.2 ug/L. Chlorophyll-a is just above the threshold described in the CALM but dissolved oxygen problems are not evident in the Little Bay dissolved oxygen data. The eelgrass beds are severely degraded (100% reduction from historic) and the available light attenuation (median=01.075 m^-1 (n=45)) is poor. For shallow systems, it is expected that changes in macroalgae will precede changes in phytoplankton (McGlathery, Sundbäck, & Anderson, 2007) (Valiela, et al., 1997), as appears to be occurring in the Great Bay Estuary. Burdick et al. (Burdick, Mathieson, Peter, & Sydney, 2016) note that, "Monitoring results from 2014 show high levels of cover of nuisance green and red algae (*Ulva* and *Gracilaria*, respectively) at all sites except near the mouth of the Estuary." That study included several sites within Little Bay. At this time there are some of the classic indicators of nutrient eutrophication present in this assessment zone and total nitrogen remains elevated. However, there are insufficient response datasets leading to the determine that eutrophication by total nitrogen is alone is not known to be strong enough to warrant impairment under New Hampshire's narrative standard. As such, this assessment zone has been assessed as Insufficient Information – Potentially Not Supporting (3-PNS) for total nitrogen.

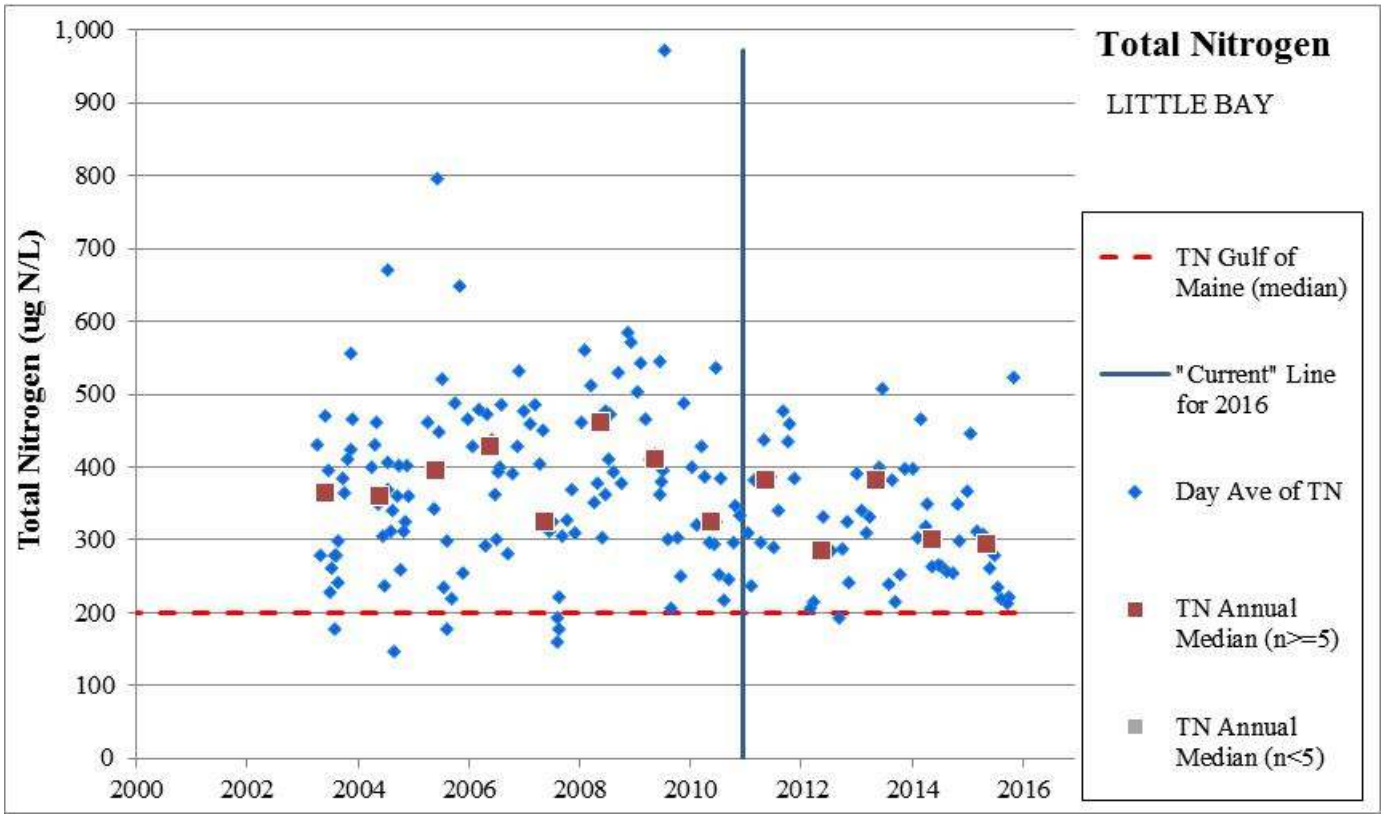

Chlorophyll-a
LITTLE BAY
ug Chl-a / L
30
25
20
15
10
5
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
Chl-a Ind. (90th percentile)
"Current" Line for 2016
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN


Dissolved Oxygen Concentration
LITTLE BAY
Dissolved Oxygen, mg / L
16
14
12
10
8
6
4
2
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2016
DO-PPM-GRAB-NCP
DO-PPM-GRAB-CP


Dissolved Oxygen Percent Saturation
LITTLE BAY
Dissolved Oxygen, Percent Saturation
160
140
120
100
80
60
40
20
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2016
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP


Light Attenuation
LITTLE BAY
Kd 1 / m (PAR) (lower is better)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
Min. for Survival Indicator (median)
"Current" Line for 2016
Light Attenuation Coefficient


Eelgrass Cover in Little Bay
Cover (acres)
60
50
40
30
20
10
0
1990
1995
2000
2005
2010
2015
2020
Year
No statistically significant trend
Short (UNH)
Trend
Kappa/Barker

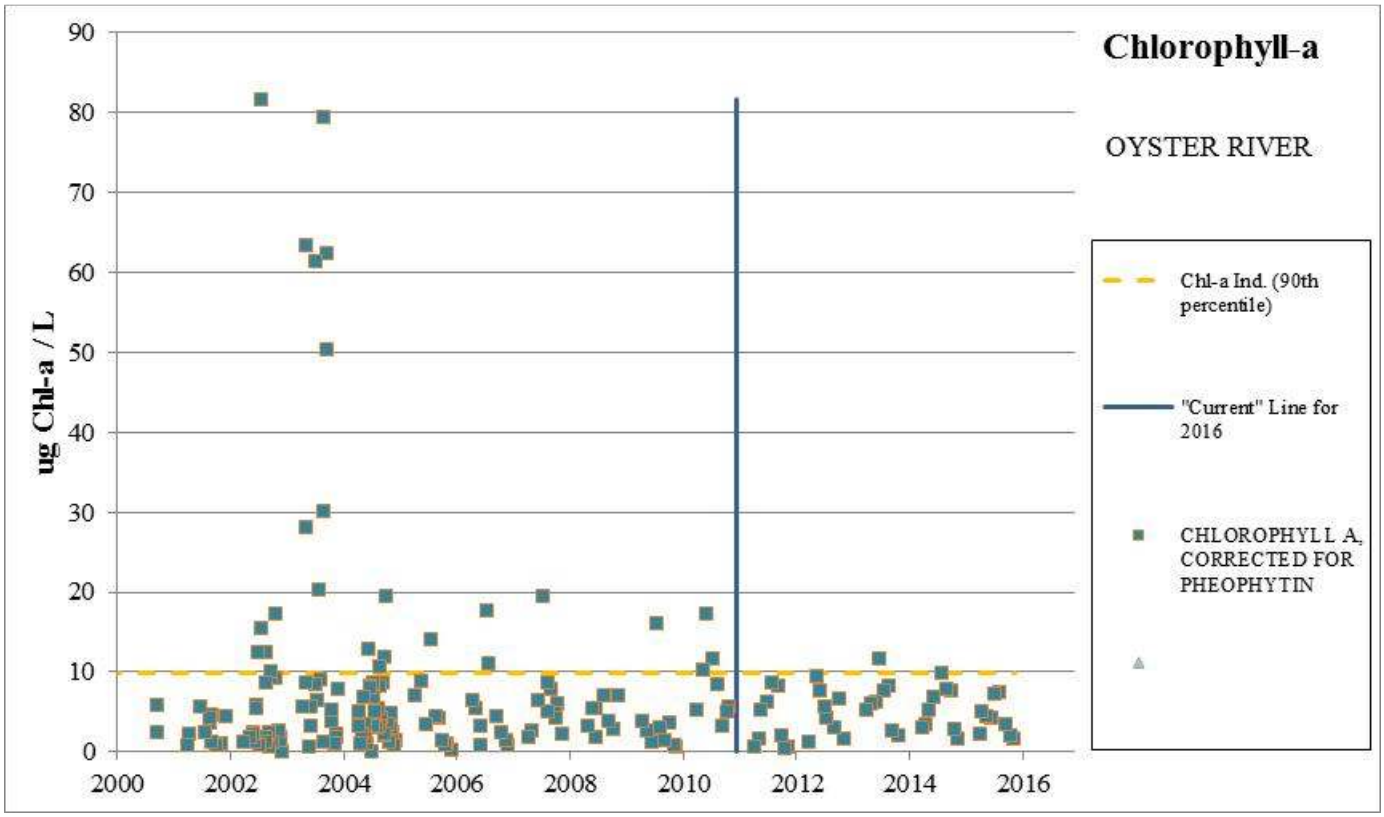

Total Nitrogen
LITTLE BAY
Total Nitrogen (ug N/L)
1,000
900
800
700
600
500
400
300
200
100
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
TN Gulf of Maine (median)
"Current" Line for 2016
Day Ave of TN
TN Annual Median (n>=5)
TN Annual Median (n<5)

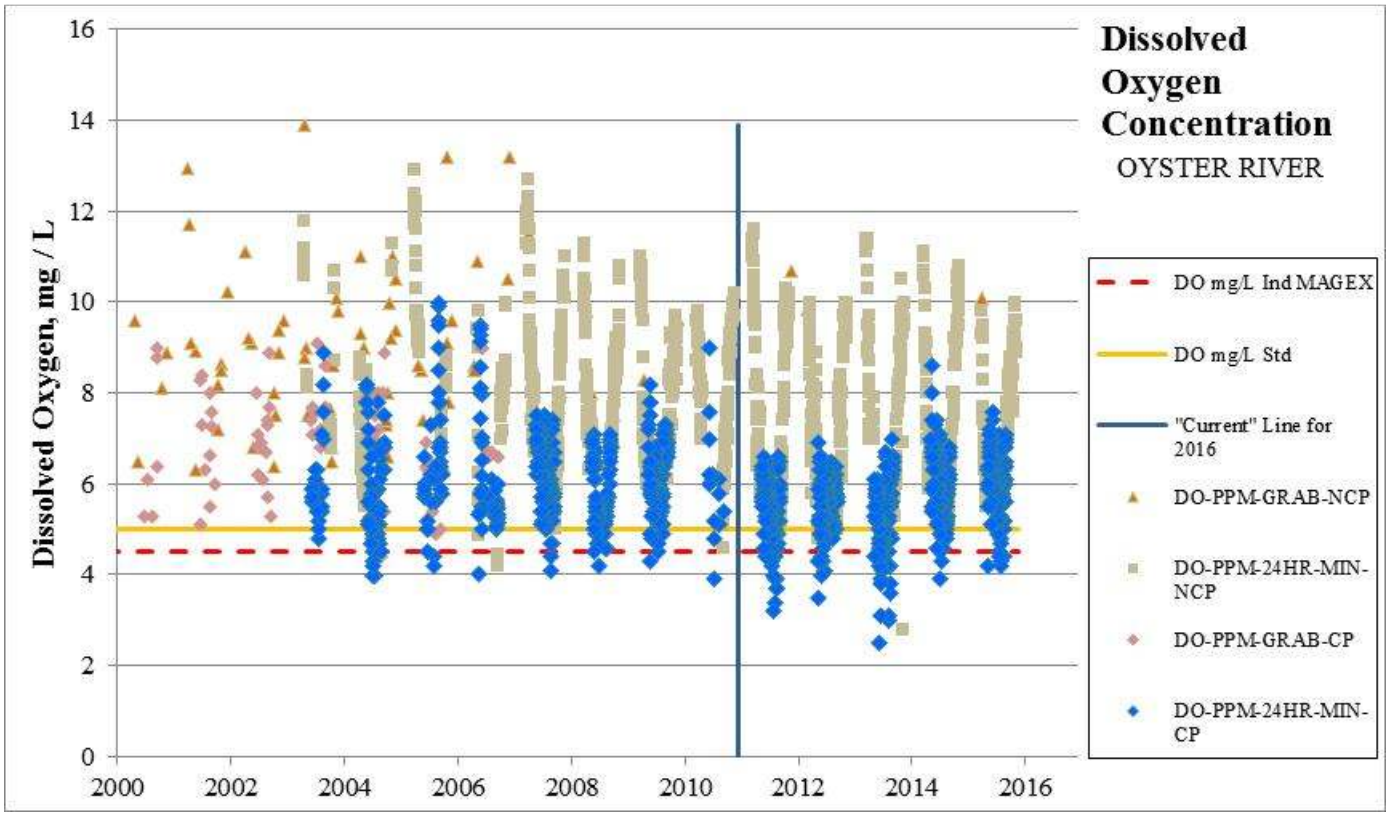
Little Bay Assessment Zone	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	59	0.8	3.8	**11.0**	25.2
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	0	-	-	**-**	-
CHLOROPHYLL A, combined	59	0.0	3.8	11.0	25.2
DO-PERC-24H-MEAN-CP	0	-	-	**-**	-
DO-PERC-24H-MEAN-NCP	0	-	-	**-**	-
DO-PERC-2TIDE-GRAB-CP	17	52.2	96.8	113.8	115.2
DO-PERC-2TIDE-GRAB-NCP	39	79.6	98.0	114.9	118.9
DO-PPM-24HR-MIN-CP	0	-	-	**-**	-
DO-PPM-24HR-MIN-NCP	0	-	-	**-**	-
DO-PPM-GRAB-CP	19	5.7	7.3	8.4	8.9
DO-PPM-GRAB-NCP	40	7.4	10.3	13.5	14.0
LIGHT ATTENUATION COEFFICIENT	45	0.480	**1.075**	1.815	2.480
TURBIDITY	0	-	-	**-**	-
Day Ave of TN	58	194	**310**	447	524
Day Ave of TDN	61	128	218	363	479
Day Ave of DIN (NH3 + NO2/3)	61	8	96	211	290
Day Ave of NH3	61	3	34	74	85
Day Ave of PON	0	-	-	**-**	-
Day Ave of NO2/3	61	3	71	161	216

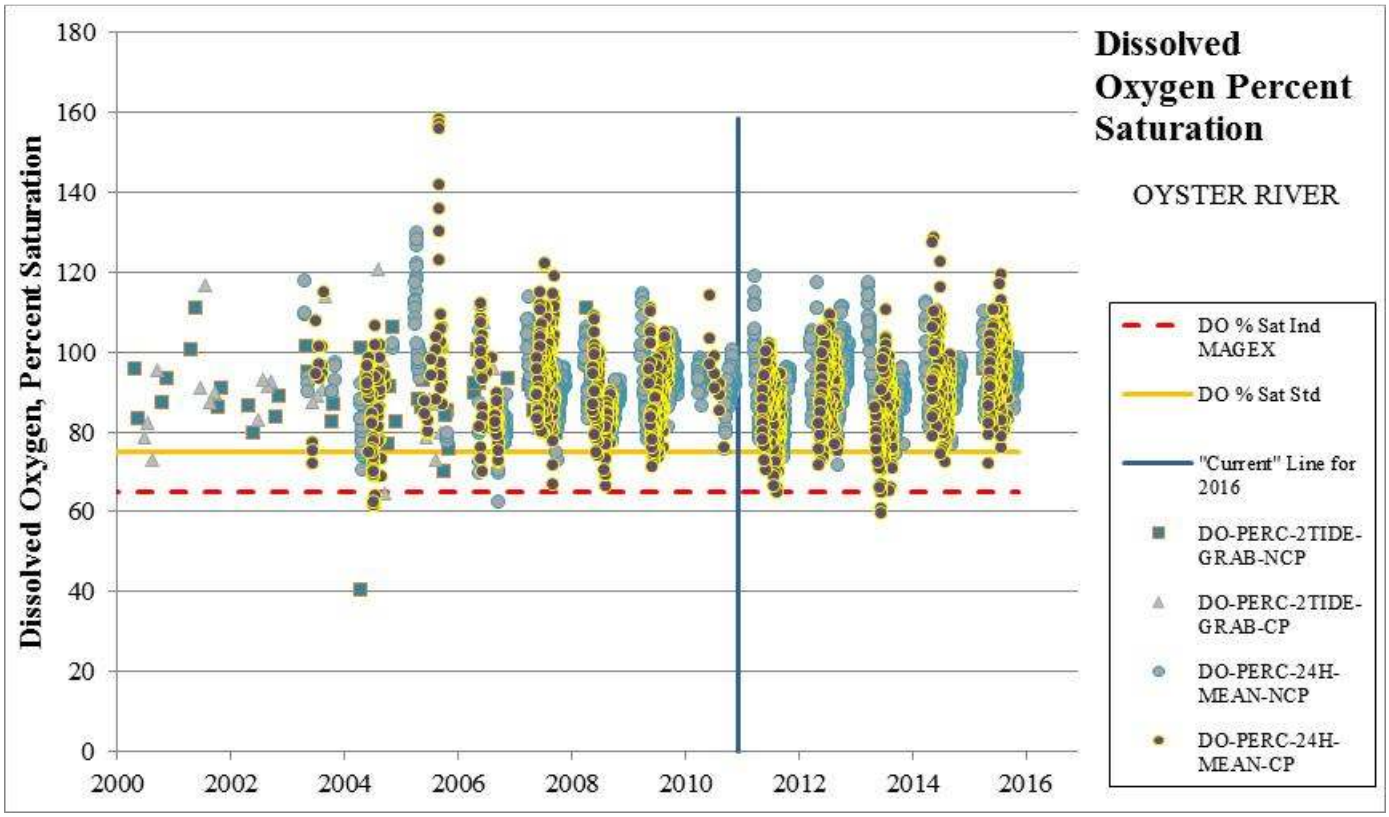
Assessment Zone = OYSTER RIVER

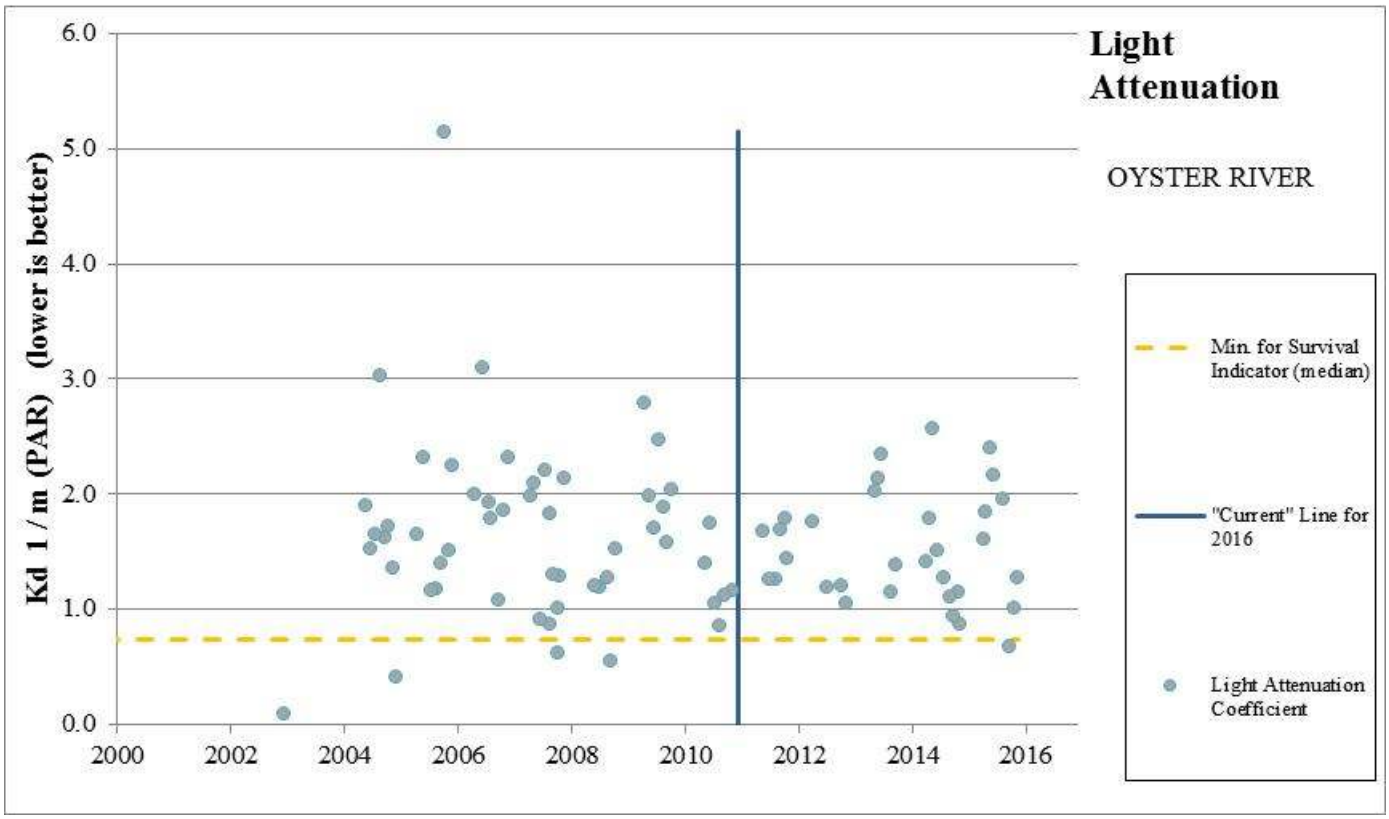
(NHEST600030902-01-03, NHEST600030904-06-17)

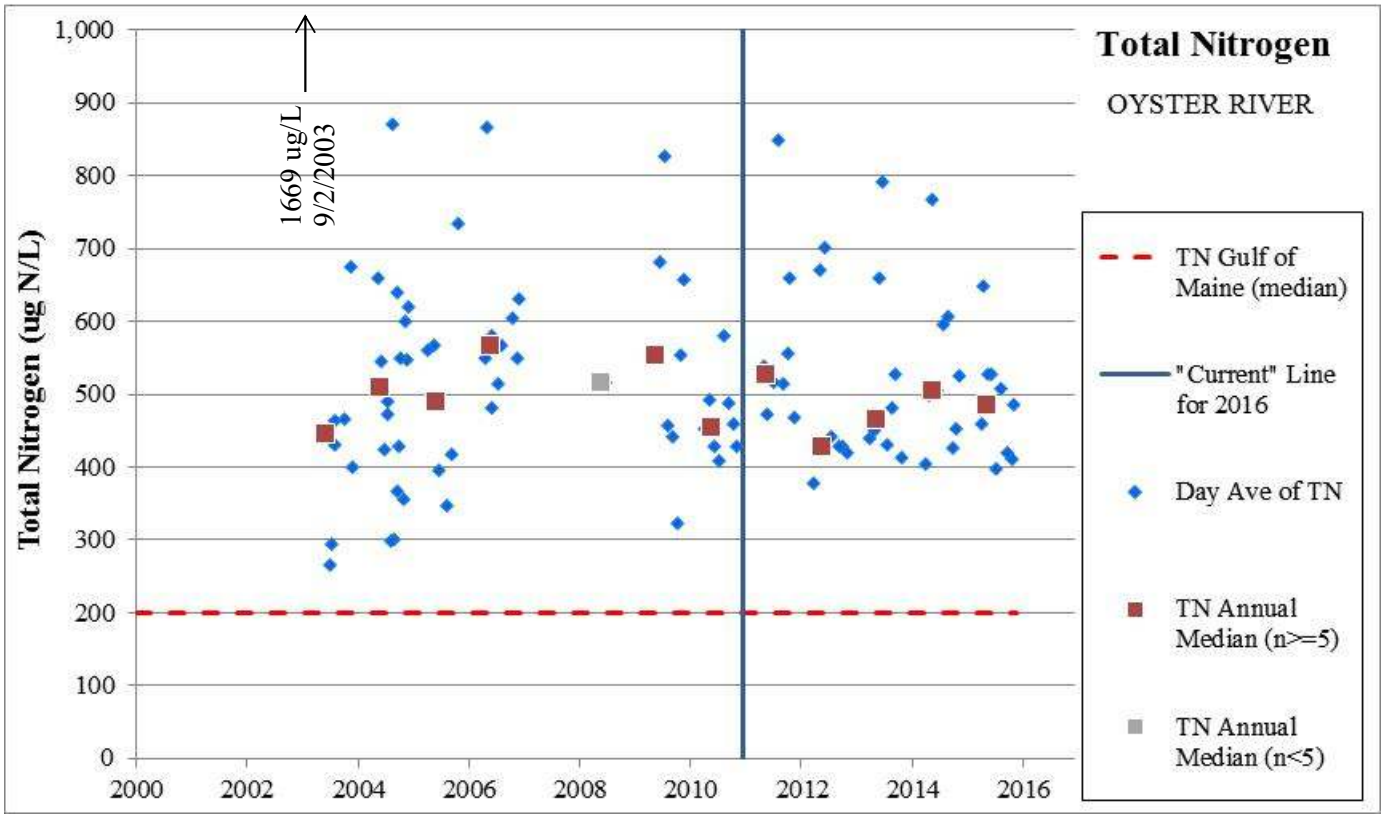
Indicator	Aquatic Life Use Category 2014 / 2016	2016 Comment
Chlorophyll-a	5M / 2-M	The calculated 90th percentile chlorophyll-a in this assessment zone is 8.5 ug/L (n = 43) and a maximum reading of 11.8 ug/L. The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. Large Chlorophyll-a blooms have not occurred in the assessment unit for many years. Therefore, the impaired (5-M) listing from the 2014 303d list has changed to marginally fully supporting (2-M) for the 2016 assessment.
Dissolved Oxygen (mg/L)	5-P /5-P	While the minimum dissolved oxygen concentration appears to be improving, dissolved oxygen concentration measurements in this assessment zone fall below the 5 mg/L criteria every year. In most years a portion of those measurements fall below 4 mg/L and in some years below 3 mg/L, therefore this impairment is considered severe.
Dissolved Oxygen (% Saturation)	5-P /5-P	While the minimum dissolved oxygen saturation appears to be improving and less than 10% of daily averages fall below 75% (40 or 590 days), dissolved oxygen 24 hour average percent saturation measurements in this assessment zone fall below the 75 percent criteria nearly every year. In many years a portion of those measurements fall below 65 percent, therefore this impairment is considered severe.
Estuarine Bioassessments (eelgrass)	5-P /5-P	The historical extent of eelgrass in this assessment zone was 182.5 acres from the 1948 dataset. Some of eelgrass was found in 1996 (14 acres). The median current extent of eelgrass in 2014-2016 is 0 acres, which is a decrease of 100%. Since 1990, the trend in eelgrass cover in this assessment zone could not be determined because the eelgrass cover has been zero for most years since 1981. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	5-P /5-P	Median=1.445 m^-1 (n=32). For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1. The recent mapping (2015 showed 2.4 acres, the first observed eelgrass since the 1996 mapping effort) shows eelgrass principally in the shallow areas. Older datasets had eelgrass growing in both the shallow and deeper habitat. The potential for the deeper habitat and the improved restoration potential provided by improved water clarity make the 2m restoration depth a valid target. Therefore, the impaired (5-P) listing from the 2014 303d list has been retained.
Total Nitrogen	5-P /5-M	The median total nitrogen from 2011 through 2015 was 499 ug/L (n=41). This assessment zone experiences frequent dissolved oxygen concentrations well below 5 mg/L and, at times, below 3 mg/L. The daily average dissolved oxygen percent saturation falls below 75 percent nearly every year and at times below 65 percent. During multiple years this assessment zone has also demonstrated super saturation over 125% including peak saturations of 163% (2015), 191% (2014), 145% (2013), 151% (2012), and 141% (2011). The chlorophyll-a concentration 90th percentile was 8.5 (n=43) from 2011 through 2015. The eelgrass beds are degraded and the available light attenuation (median=1.445 m^-1 (n=32)) is poor. The nearest POTW discharge is actively ratcheting down their nitrogen discharge but at this time many of the classic indicators of nutrient eutrophication are present in this assessment zone. As such, the impairment for nitrogen has been retained.


Chlorophyll-a
OYSTER RIVER
ug Chl-a / L
90
80
70
60
50
40
30
20
10
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
Chl-a Ind. (90th percentile)
"Current" Line for 2016
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN


Dissolved Oxygen Concentration
OYSTER RIVER
Dissolved Oxygen, mg / L
16
14
12
10
8
6
4
2
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2016
DO-PPM-GRAB-NCP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-24HR-MIN-CP


Dissolved Oxygen Percent Saturation
OYSTER RIVER
Dissolved Oxygen, Percent Saturation
180
160
140
120
100
80
60
40
20
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2016
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP
DO-PERC-24H-MEAN-NCP
DO-PERC-24H-MEAN-CP


Light Attenuation
OYSTER RIVER
Kd 1 / m (PAR) (lower is better)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
Min. for Survival Indicator (median)
"Current" Line for 2016
Light Attenuation Coefficient

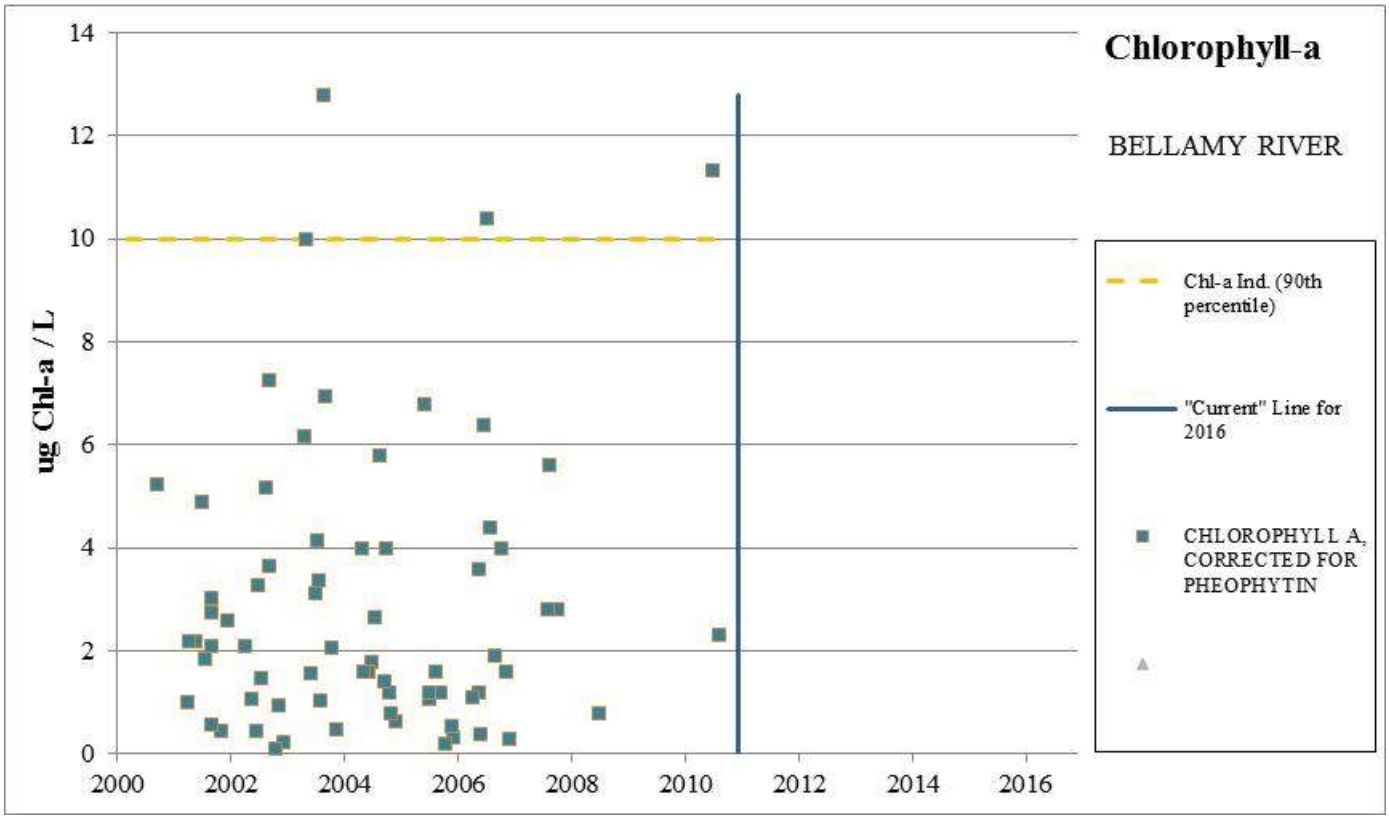


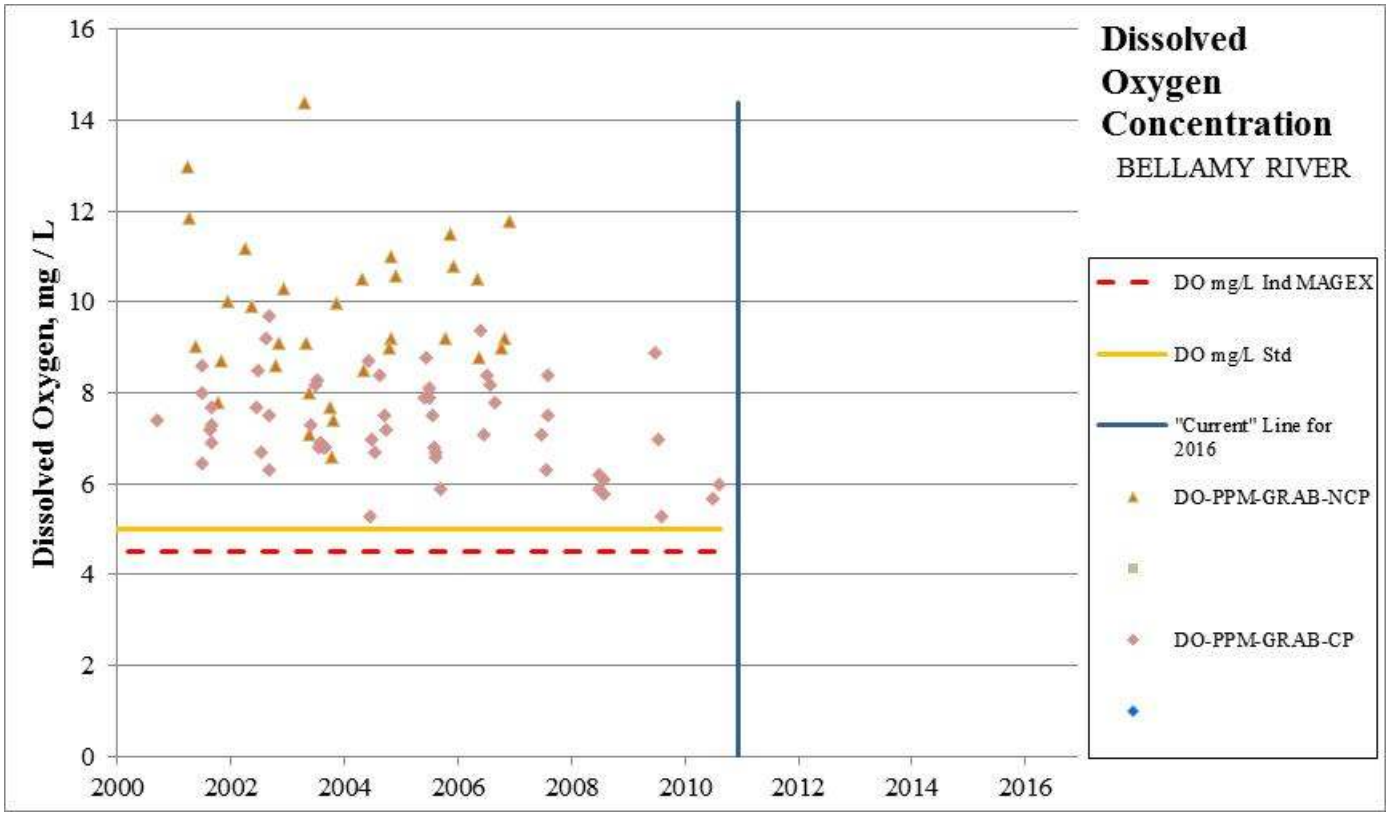
Oyster River Assessment Zone	Count	Minimum	Median	90th Percentile	Maximum
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	43	0.5	5.1	**8.5**	11.8
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	0	-	-	-	-
CHLOROPHYLL A, combined	43	0.0	5.1	8.5	11.8
DO-PERC-24H-MEAN-CP	590	59.7	89.8	103.3	128.7
DO-PERC-24H-MEAN-NCP	546	71.7	92.5	103.4	119.3
DO-PERC-2TIDE-GRAB-CP	0	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP	1	95.7	95.7	-	95.7
DO-PPM-24HR-MIN-CP	586	2.5	5.8	6.6	8.6
DO-PPM-24HR-MIN-NCP	543	2.8	8.0	9.9	11.6
DO-PPM-GRAB-CP	0	-	-	-	-
DO-PPM-GRAB-NCP	3	9.8	10.1	-	10.7
LIGHT ATTENUATION COEFFICIENT	32	0.690	**1.445**	2.306	2.590
TURBIDITY	1,131	0.0	9.0	49.8	469.0
Day Ave of TN	41	378	**499**	696	850
Day Ave of TDN	44	238	357	503	618
Day Ave of DIN (NH3 + NO2/3)	44	44	202	328	408
Day Ave of NH3	44	24	75	163	206
Day Ave of PON	0	-	-	-	-
Day Ave of NO2/3	44	4	104	222	295

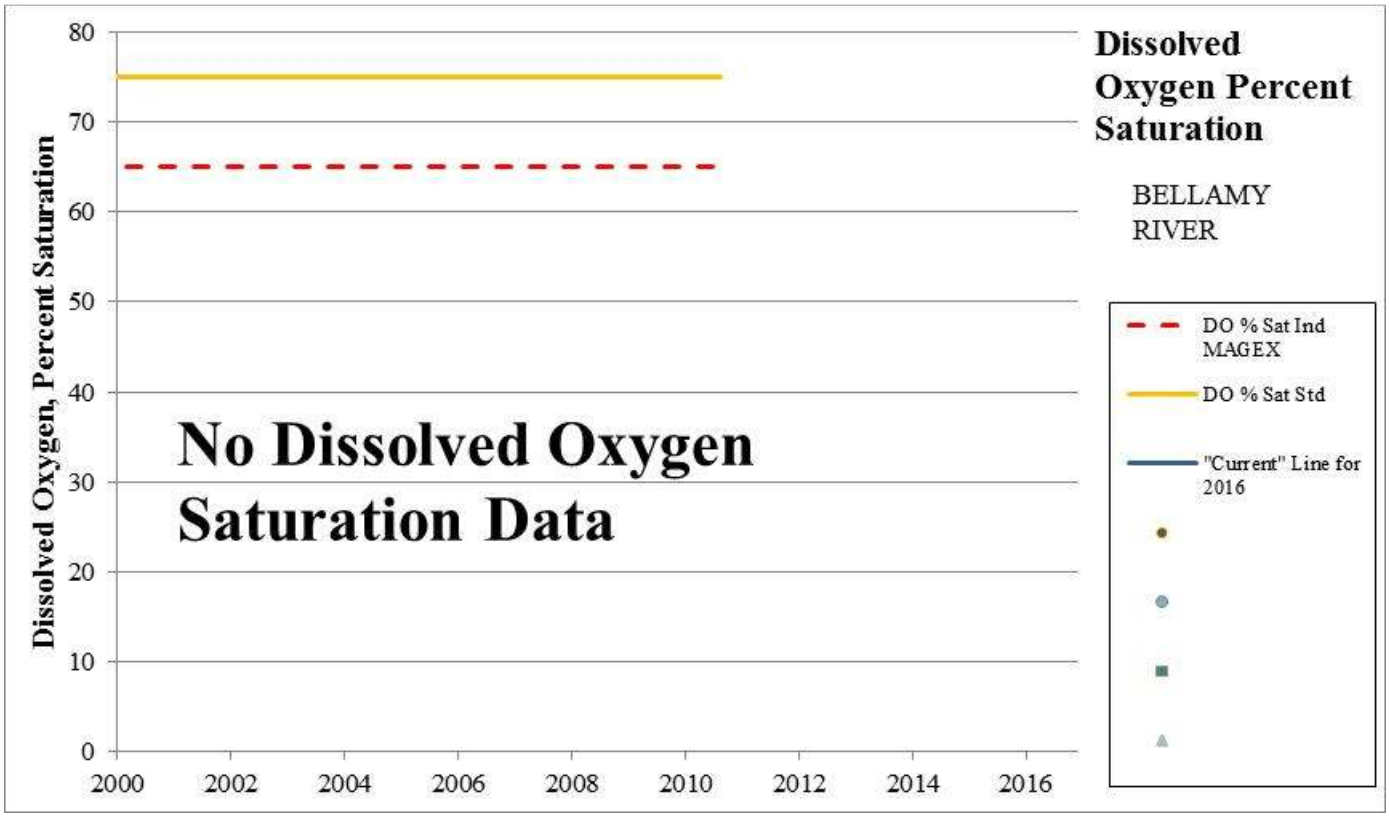
Assessment Zone = BELLAMY RIVER

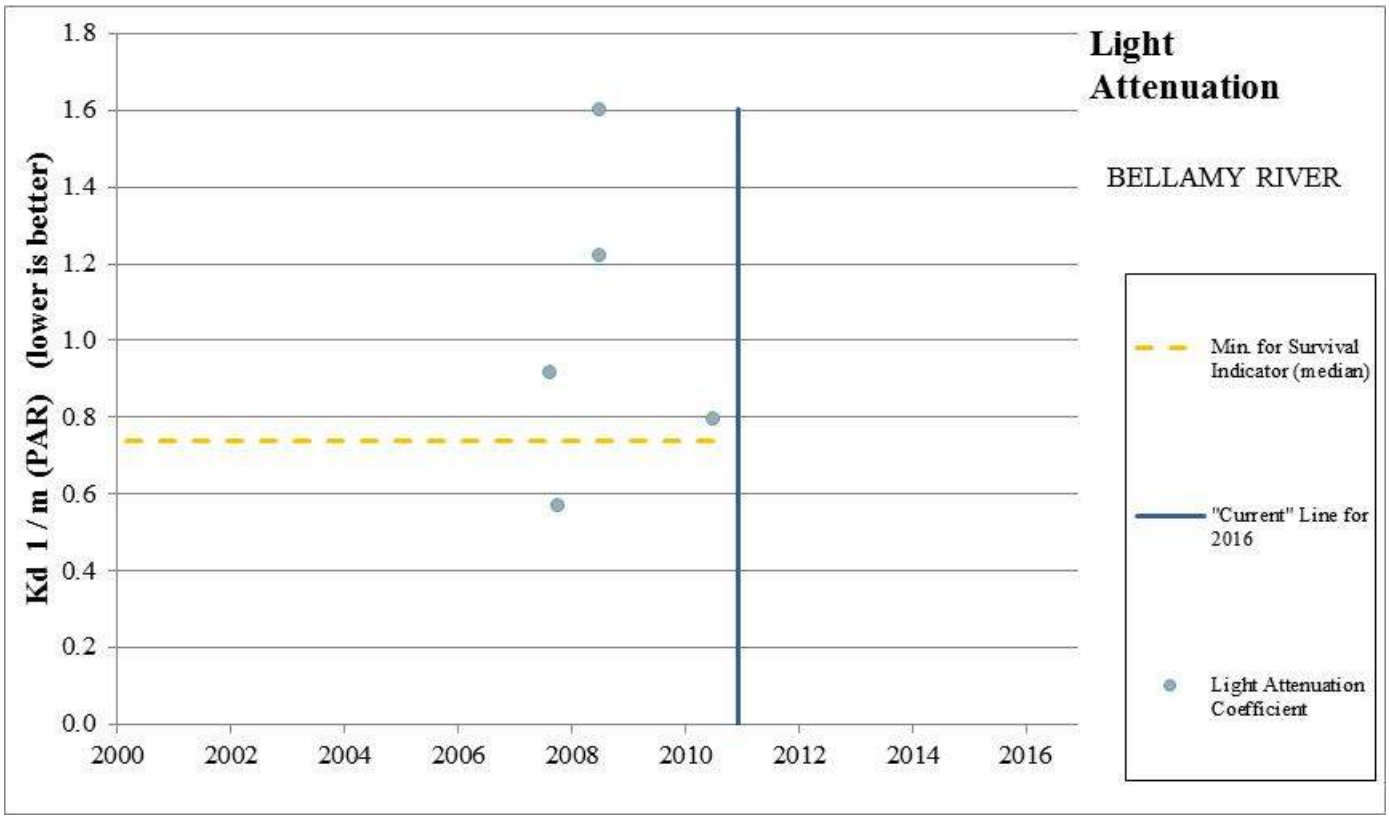
(NHEST600030903-01-01, NHEST600030903-01-03, NHEST600030903-01-04)

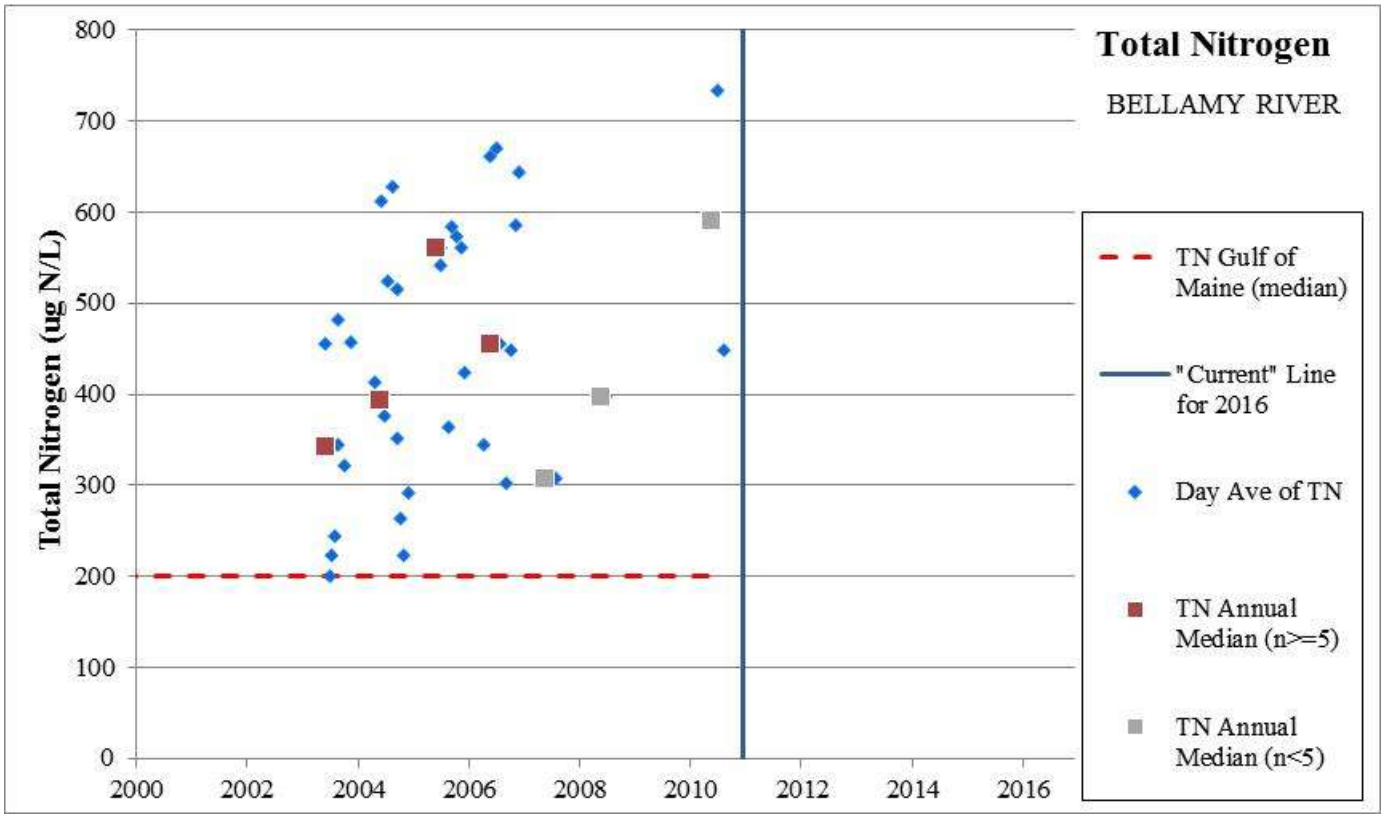
Indicator	Aquatic Life Use Category 2014 / 2016	2016 Comment
Chlorophyll-a	3-PNS / 3-ND	The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. This assessment zone has no measurements for chlorophyll-a since 2010.
Dissolved Oxygen (mg/L)	3-PAS / 3-ND	This assessment zone has no measurements for dissolved oxygen concentration since 2010. As such, this assessment zone has been assessed as 3-ND (No Data) dissolved oxygen concentration.
Dissolved Oxygen (% Saturation)	3-ND / 3-ND	This assessment zone has no measurements for dissolved oxygen percent saturation. As such, this assessment zone has been assessed as 3-ND (No Data) dissolved oxygen percent saturation.
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 66.9 acres from the 1948, 1962, 1980, and 1981 datasets. Some eelgrass was found in 2004 (0.8 acres). The median current extent of eelgrass in 2014-2016 is 0 acres, which is a decrease of 100%. Since 1990, the trend in eelgrass cover in this assessment zone could not be determined because the eelgrass cover has been zero for most years since 1981. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	3-PNS / 3-ND	There have been no light measurements collected since 2010. For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1. As such, this assessment zone has been assessed as 3-ND (No Data) dissolved oxygen percent saturation.
Total Nitrogen	3-PNS / 3-ND	There are no 'current' total nitrogen data from which to calculate a median total nitrogen from 2011 through 2015. There are no data to evaluate dissolved oxygen concentration or percent saturation, chlorophyll-a, or light attenuation. Eelgrass has been absent from this assessment zone since 1981 with small reoccurrence in 2004 (0.8 acres). No sampling efforts have taken place to evaluate the extent of epiphytes and macrophytes. This assessment zone is generally characterized by its lack of eutrophication indicator data. There are not sufficient datasets to determine that eutrophication by total nitrogen is alone is not known to be strong enough to warrant impairment under New Hampshire's narrative standard. As such, this assessment zone has been assessed as 3-ND (No Data) total nitrogen.


Chlorophyll-a
BELLAMY RIVER
ug Chl-a / L
0
2
4
6
8
10
12
14
2000
2002
2004
2006
2008
2010
2012
2014
2016
Chl-a Ind. (90th percentile)
"Current" Line for 2016
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN


Dissolved Oxygen Concentration
BELLAMY RIVER
Dissolved Oxygen, mg / L
0
2
4
6
8
10
12
14
16
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2016
DO-PPM-GRAB-NCP
DO-PPM-GRAB-CP


Dissolved Oxygen Percent Saturation
BELLAMY RIVER
Dissolved Oxygen, Percent Saturation
80
70
60
50
40
30
20
10
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
No Dissolved Oxygen Saturation Data
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2016


Light Attenuation
BELLAMY RIVER
Kd 1 / m (PAR) (lower is better)
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
Min. for Survival Indicator (median)
"Current" Line for 2016
Light Attenuation Coefficient



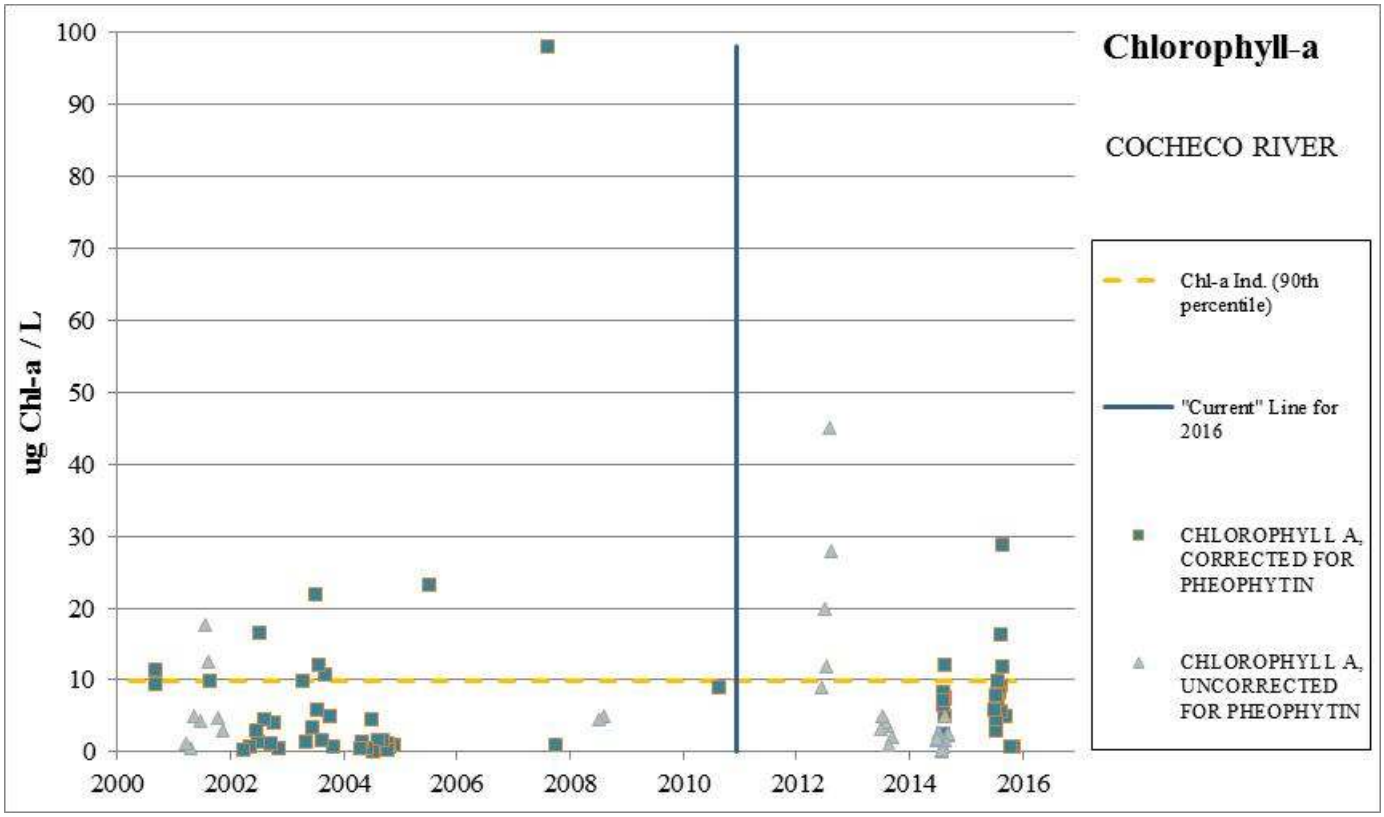
Bellamy River Assessment Zone	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	0	-	-	-	-
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	0	-	-	-	-
CHLOROPHYLL A, combined	0	-	-	-	-
DO-PERC-24H-MEAN-CP	0	-	-	-	-
DO-PERC-24H-MEAN-NCP	0	-	-	-	-
DO-PERC-2TIDE-GRAB-CP	0	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP	0	-	-	-	-
DO-PPM-24HR-MIN-CP	0	-	-	-	-
DO-PPM-24HR-MIN-NCP	0	-	-	-	-
DO-PPM-GRAB-CP	0	-	-	-	-
DO-PPM-GRAB-NCP	0	-	-	-	-
LIGHT ATTENUATION COEFFICIENT	0	-	-	-	-
TURBIDITY	0	-	-	-	-
Day Ave of TN	0	-	-	-	-
Day Ave of TDN	0	-	-	-	-
Day Ave of DIN (NH3 + NO2/3)	0	-	-	-	-
Day Ave of NH3	0	-	-	-	-
Day Ave of PON	0	-	-	-	-
Day Ave of NO2/3	0	-	-	-	-

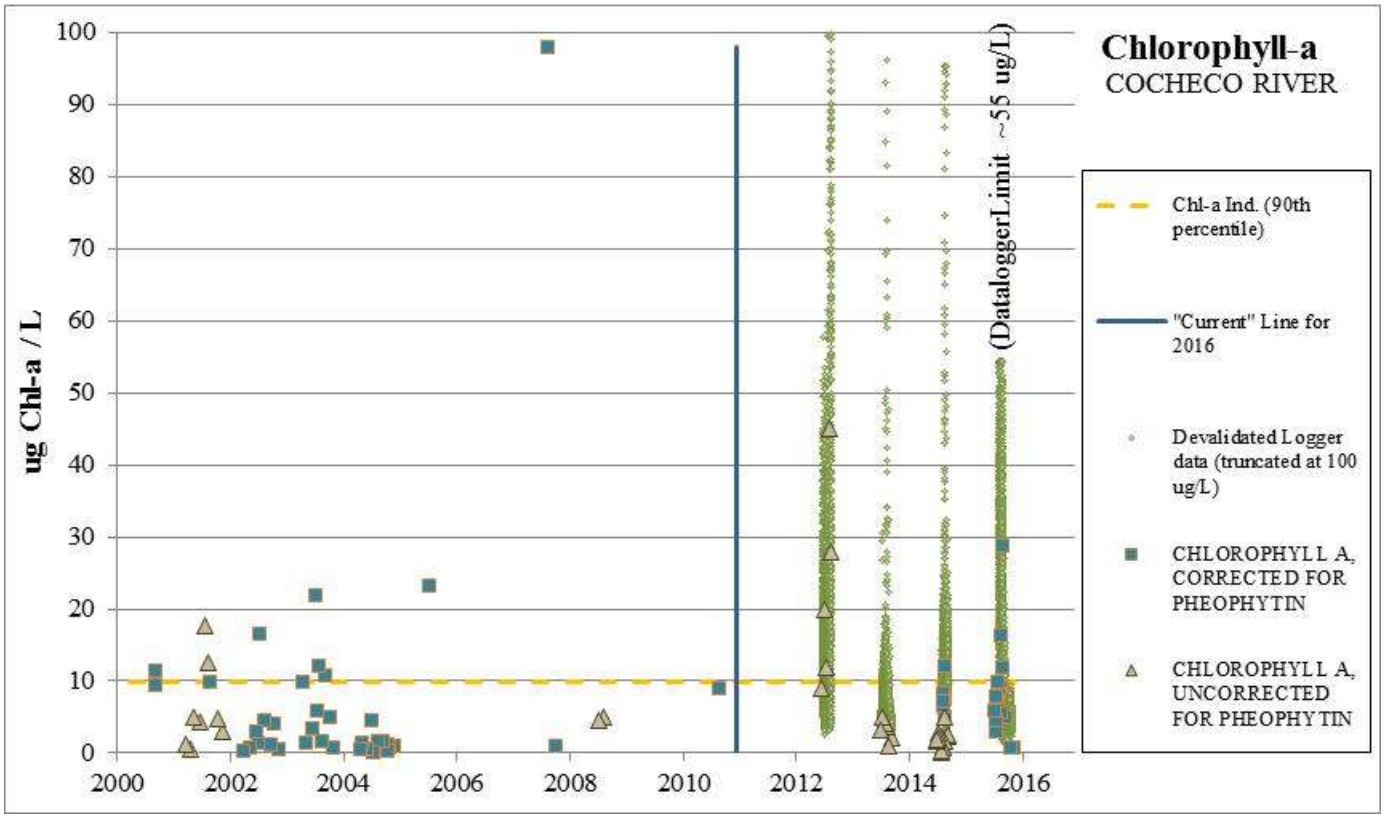
Assessment Zone = COCHECO RIVER

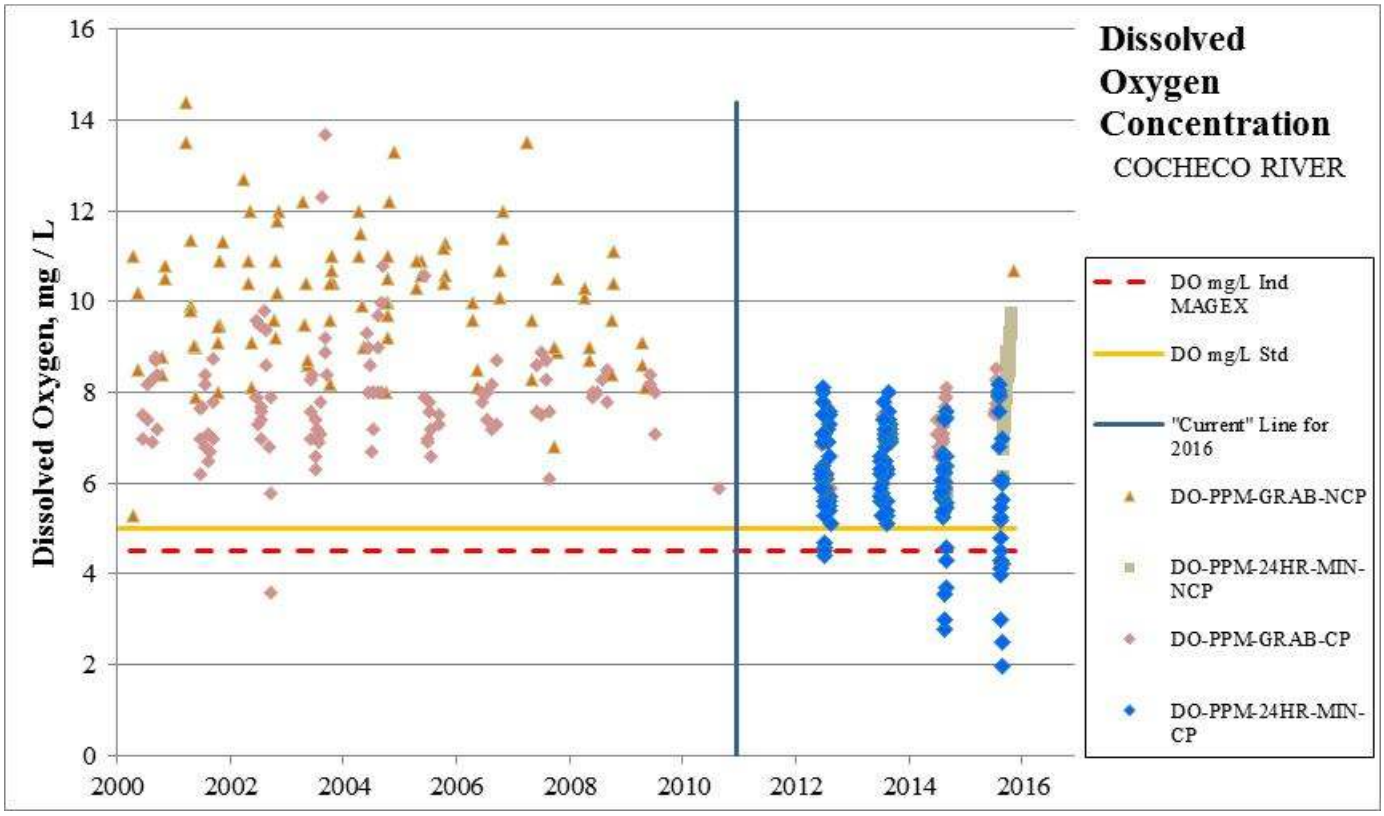
(NHEST600030608-01)

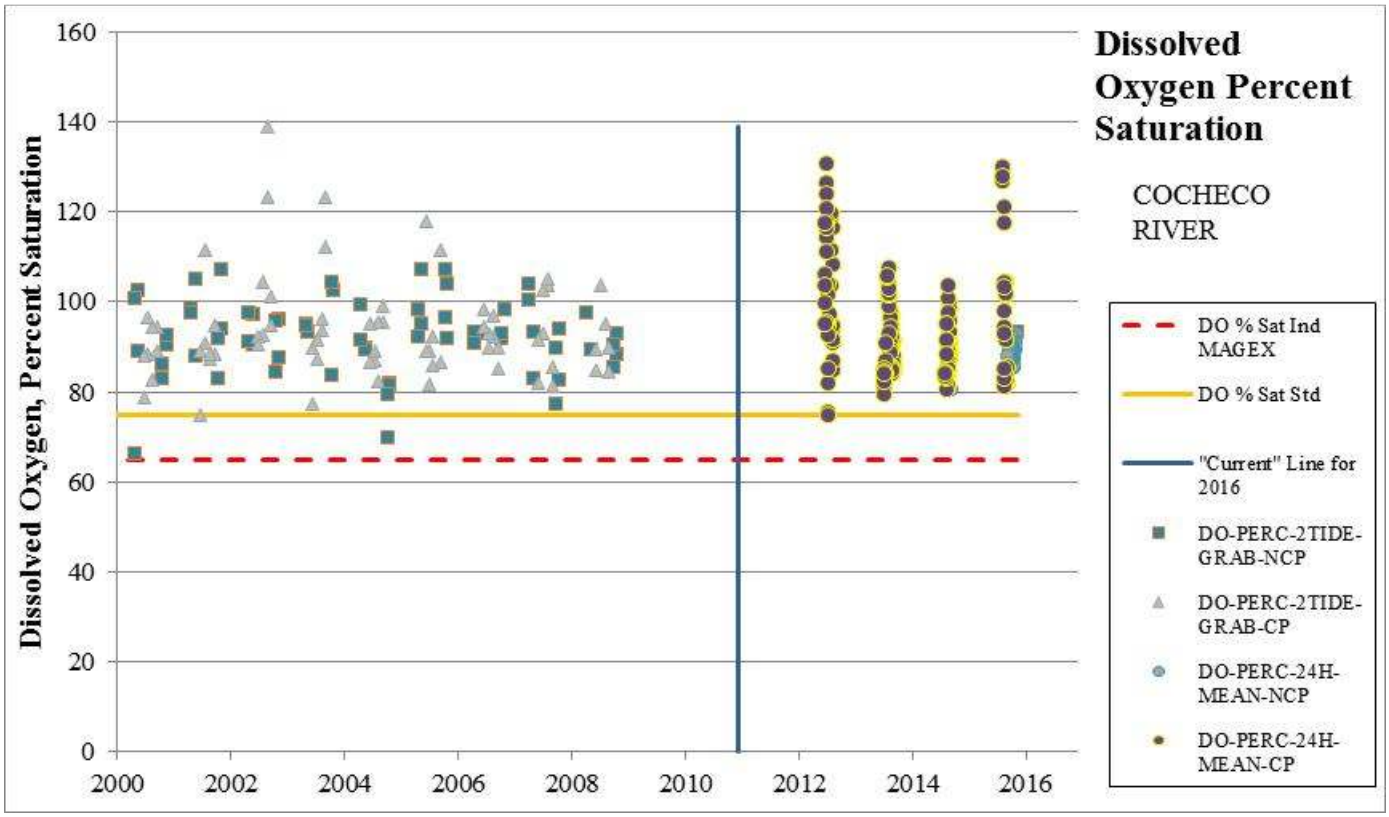
Indicator	Aquatic Life Use Category 2014 / 2016	2016 Comment
Chlorophyll-a	5-P /5-P	The calculated 90th percentile chlorophyll-a in this assessment zone is 14.6 ug/L (n = 46) and a maximum reading of 45 ug/L. The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. Although the multiple probe based chlorophyll-a data (not used in the median above) collected in the assessment zone was qualified as "estimated," due to poor correlation between probe and extracted chlorophyll-a grab sample data, the relative biomass is valid and shows large spikes in chlorophyll-a. Those spikes were most pronounced when low tide (maximum freshwater signal and maximum water temperature) occurred at midday to late afternoon (maximum photosynthesis duration period) and when freshwater inflow was at a minimum (0.23 – 0.10 cfsm) (minimum dilution of upstream loading). Under those conditions, the high nutrient water in the Cocheco River had the optimum conditions to sustain a large phytoplankton biomass.
Dissolved Oxygen (mg/L)	3-PNS / 5-M	Following the 10% method listed in the 2016 CALM, this parameter would be categorized as 5-M. Part of the concept behind the 10% rule was to address random errors within the meter measurement accuracy thereby limiting accidental impairments. The magnitude of exceedence indicator was layered into the assessment process to address major exceedences and exceedences beyond all normal measurement errors. In this assessment zone, there are 163 station/days of datalogger DO readings during the critical summer period. Of the overall dataset, there were 20 days on which DO fell below 5 mg/L for 0.25 to 4.25 hours; there were 8 days on which DO fell below 4 mg/L for 0.25 to 1.25 hours; there were 4 days on which DO fell below 3 mg/L for 0.25 to 0.5 hours; and there was 1 day on which DO fell below 2 mg/L for 0.25 hour. Most of those low DO reading occurred in 2015 at station CR7. The frequency, duration, and magnitude of those DO excursions warrant impairment. Given the concerted effort by the municipalities to reduce nutrient loading through infrastructure investments, nonpoint source controls and stormwater ordinances, NHDES anticipates that the condition will improve in the coming years.
Dissolved Oxygen (% Saturation)	2-M / 2-M	Dissolved oxygen percent saturation has been assessed using dataloggers from 2012 through 2015. On only one occasion did the 24 hour average percent saturation fall below 75 percent (74.7 percent over July 27, 2012). While the 2012 datalogger deployment at CR1 saw the most severe dissolved oxygen saturation swings and super saturation conditions, the hour average percent saturation fell below 75 percent only on that one date.
Estuarine Bioassessments (eelgrass)	No Std/ No Std	Not applicable. Eelgrass habitat has not historically existed in this assessment zone.
Water Clarity (Light Attenuation Coefficient)	No Std/ No Std	Not applicable. The water clarity has not been assessed because eelgrass has not historically existed in this assessment zone.
Total Nitrogen	3-PNS / 5-M	The median total nitrogen from 2011 through 2015 was 488 ug/L (n=38). It must be noted that recent and rapid total nitrogen reductions have occurred due to infrastructure investments by the municipalities (Rochester WWTP reductions in 2014 and Dover WWTP began reductions in 2015). This assessment zone experienced periodic dissolved oxygen concentrations below 5 mg/L in 2014 and 2015 of up to 4.25 hours and as low as 2 mg/L. The chlorophyll-a concentration 90th percentile was 14.6 ug/L (n = 46) and a maximum reading of 45 ug/L. Although the probe based chlorophyll-a data (not used in the median above) was qualified as "estimated" due to poor correlation between probe and extracted chlorophyll-a grab sample data, the relative biomass is valid and demonstrates that chlorophyll-a biomass can be quite high depending upon the timing of the tide cycle. The Cocheco River appears to be a system in flux. The graphics and

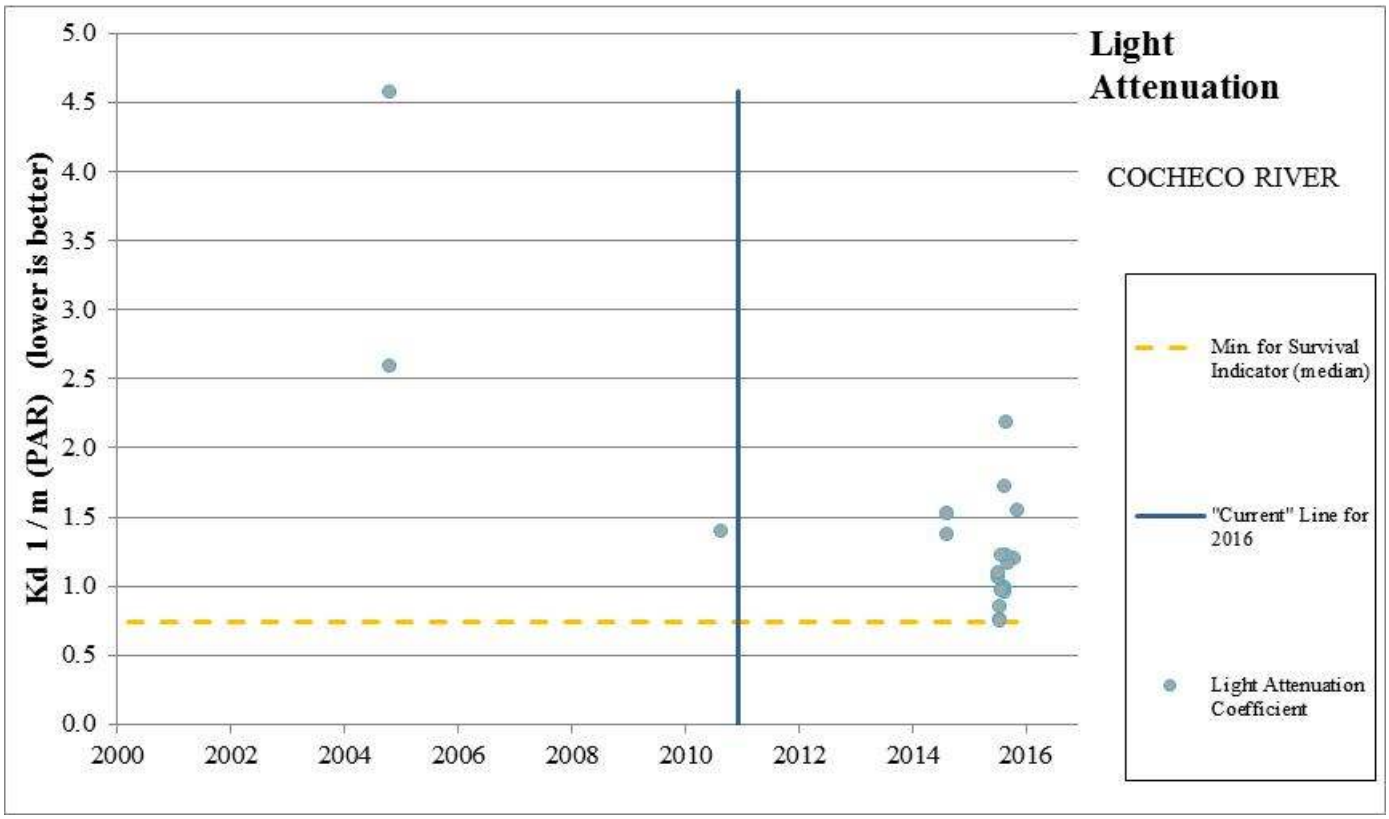
		accompanying narrative below demonstrate that the growth of algae is causing dissolved oxygen to fall below state standards. The concentrations of total nitrogen are high enough, especially at low tide and lower river flow conditions, to result in these algal blooms (see the Detailed Cocheco River 2015 Datalogger Evaluation section below.) It is not clear at this time whether the measured high chlorophyll and low DO is solely the result of current loads of nitrogen or if the historically much higher loads are still flushing through the ecosystem. Some of the classic indicators of nutrient eutrophication are present in this assessment zone and total nitrogen remains elevated. The newer datasets provide a more robust set of indicators of eutrophication than were available for the 2014 assessment and those response datasets demonstrate sufficient power to determine that the eutrophication effects on designated uses can be attributed to total nitrogen. While there is rapidly decreasing nutrient loading and improved conditions expected in the coming years, the response datasets warrant impairment under New Hampshire's narrative standard. As such, this assessment zone has been assessed as marginally non-supporting (5-M) for total nitrogen.

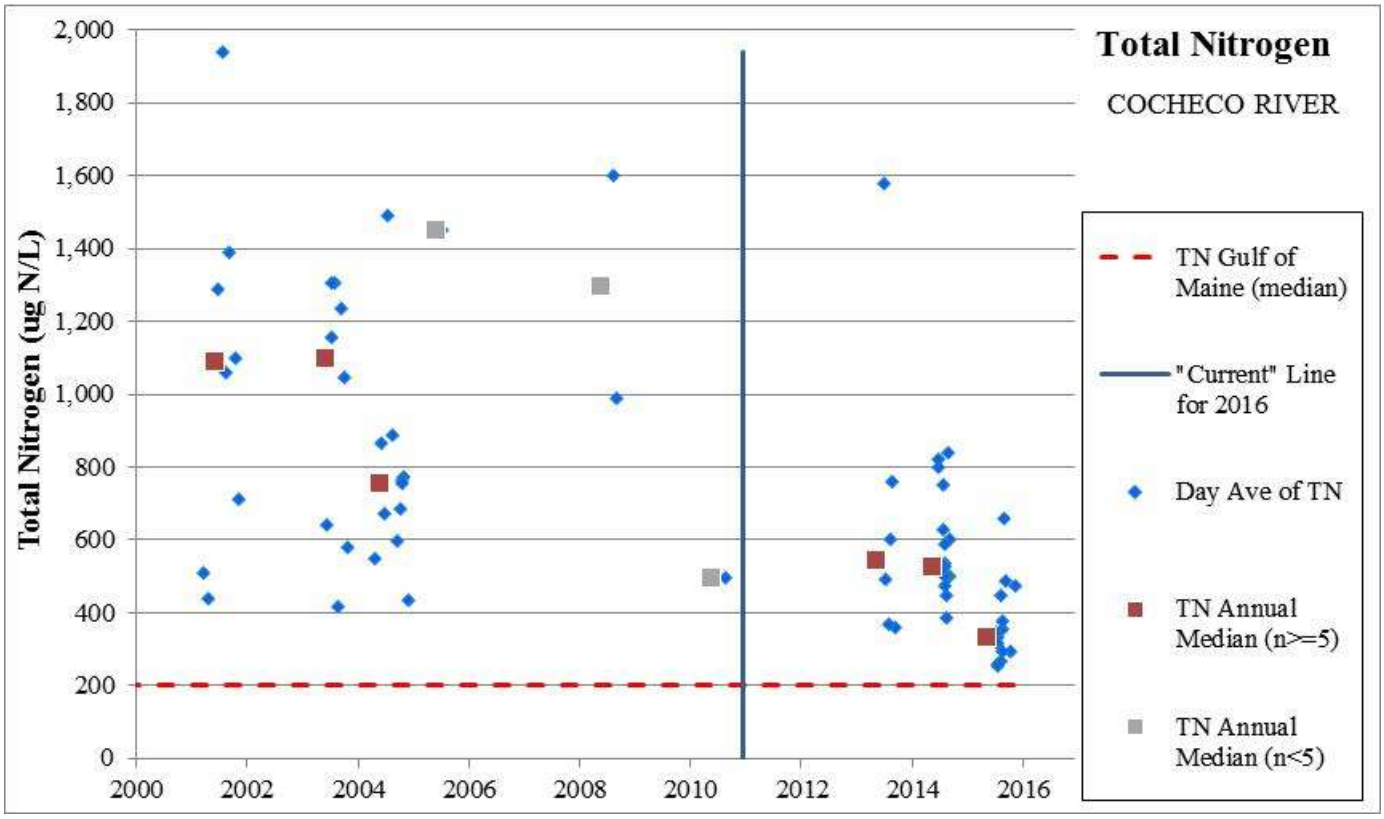



Chlorophyll-a
COCHECO RIVER
ug Chl-a / L
(DataloggerLimit ~55 ug/L)
Chl-a Ind. (90th percentile)
"Current" Line for 2016
Devalidated Logger data (truncated at 100 ug/L)
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN


Dissolved Oxygen Concentration
COCHECO RIVER
Dissolved Oxygen, mg / L
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2016
DO-PPM-GRAB-NCP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-24HR-MIN-CP

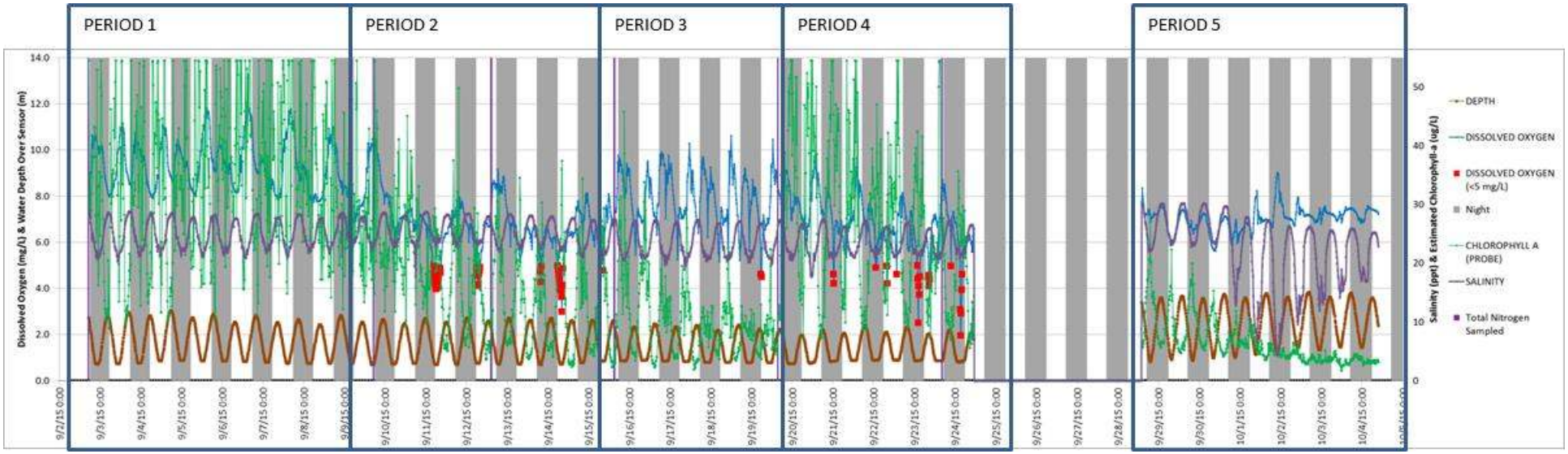

Dissolved Oxygen Percent Saturation
COCHECO RIVER
Dissolved Oxygen, Percent Saturation
160
140
120
100
80
60
40
20
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2016
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP
DO-PERC-24H-MEAN-NCP
DO-PERC-24H-MEAN-CP


Light Attenuation
COCHECO RIVER
Kd 1 / m (PAR) (lower is better)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
Min. for Survival Indicator (median)
"Current" Line for 2016
Light Attenuation Coefficient


Total Nitrogen
COCHECO RIVER
Total Nitrogen (ug N/L)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
TN Gulf of Maine (median)
"Current" Line for 2016
Day Ave of TN
TN Annual Median (n>=5)
TN Annual Median (n<5)

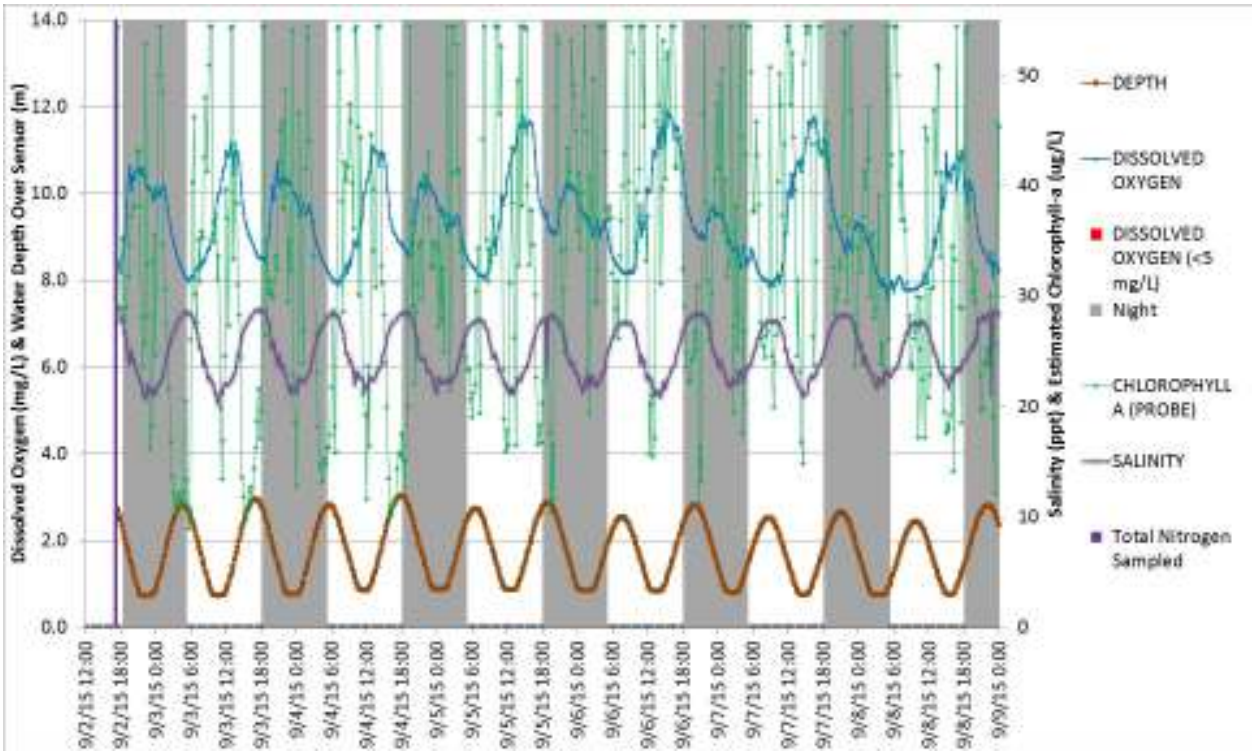
Detailed Cocheco River 2015 Datalogger Evaluation

A demonstration of the processes leading to low dissolved oxygen is provided in a series of graphics below that illustrate the conditions at station CR7 in 2015. While the median total nitrogen in 2015 in the Cocheco River was lower than it has been in years, several conditions are of note from the sampling data. While incoming tides bring low total nitrogen (269 to 376 ug/L) to the river, outgoing tides have much higher total nitrogen (447 to 660 ug/L). The head of tide total nitrogen samples at 07-CCH (Cocheco R., Rte. 9 Bridge, Central Ave.) were 848 (8/26/15), 536 (9/23/15), and 583 (10/28/15) ug/L (note that this is well below the approximately 1,500 ug/L average of August to October between 2008 and 2013). Those higher nitrogen concentration low tides were accompanied by relatively low freshwater flows. During the periods of time when the tidal Cocheco River experienced low dissolved oxygen, freshwater inputs were between 0.09 to 0.20 cfsm. For context, those flows correspond to 2 to 5 times the 7Q10 flow. The graphics below identify five time periods of interest during the summer of 2015. In the first period, chlorophyll concentrations are elevated regardless of tide and diel cycles. Photosynthesis by the water column algae drives dissolved oxygen up to 160% saturation (11.8 mg/L at the given temperatures and salinities), so high in fact that even the 3-4 mg/L drawdown during the dark period is often not enough to draw dissolved oxygen down to 100% saturation (7.9 mg/L at the given temperatures and salinities). In the second period, the chlorophyll levels cycle along with the tides. Low tide brings the highest chlorophyll concentrations down river to the datalogger, and high tide brings low chlorophyll water up river from the Piscataqua River. As a result, there is less super-saturation of dissolved oxygen as compared the first period, and when low tide occurs at night or during the early morning, the dissolved oxygen levels dip below 5 mg/L and as low as 3 mg/L due to total system respiration (the death and decomposition of the high level of algae which consume oxygen, continued respiration by the surviving chlorophyll, and other dissolved oxygen consuming sources). In the third period, chlorophyll remains low, and for the most part, dissolved oxygen remains above 5 mg/L. The fourth period demonstrates an accelerated version of the first and second periods combined. It is characterized by an early chlorophyll bloom along with super-saturation then a die-off phase resulting in dissolved oxygen below 5 mg/L and as low as 2 mg/L. After a datalogger data gap, the fifth period, which extended into early October, showed the flushing effect of freshwater river flows which rose to 3.37 cfsm, then the chlorophyll dropped, and dissolved oxygen swings between much more normal in the 75 to 95% saturation range (6.8 to 7.5 mg/L at the given temperatures and salinities).


PERIOD 1
PERIOD 2
PERIOD 3
PERIOD 4
PERIOD 5
Dissolved Oxygen (mg/L) & Water Depth Over Sensor (m)
Salinity (ppt) & Estimated Chlorophyll-a (ug/L)
DEPTH
DISSOLVED OXYGEN
DISSOLVED OXYGEN (<5 mg/L)
Night
CHLOROPHYLL A (PROBE)
SALINITY
Total Nitrogen Sampled

Summary of conditions during the 5 periods on the graph

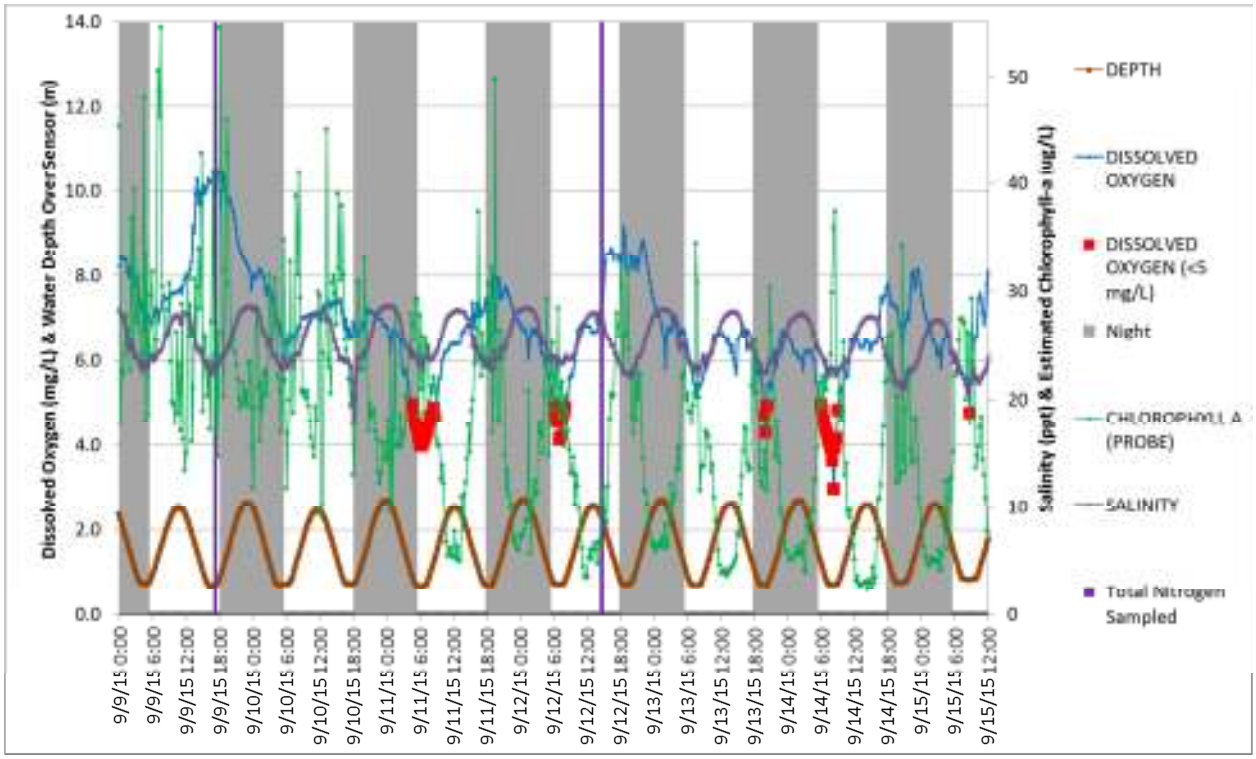
PERIOD 1



PERIOD 1

- Chlorophyll concentration is high regardless of tide cycle.
- Dissolved oxygen ranges from 100-161% Saturation at all times.
- Super saturation is so pronounced that the nightly respiration is not enough to drive DO below 5 mg/L even when low tides occur at night.
- Salinity was relatively constant between 22-28 ppt.
- Total nitrogen sampled at high tide on 9/2/2015 = 269 ug/L.
- No total nitrogen samples collected in this period above the head of tide dam, however preceding this period total nitrogen measured 848 ug/L on 8/26/2015.
- Water temperature ranged from 22 to 25C.
- Inflow based on the USGS gage #01072800 (Cocheco River near Rochester, NH) fell from 0.16 to 0.10 cfsm (40th to 22nd percentile for the month (1995 to 2016)).

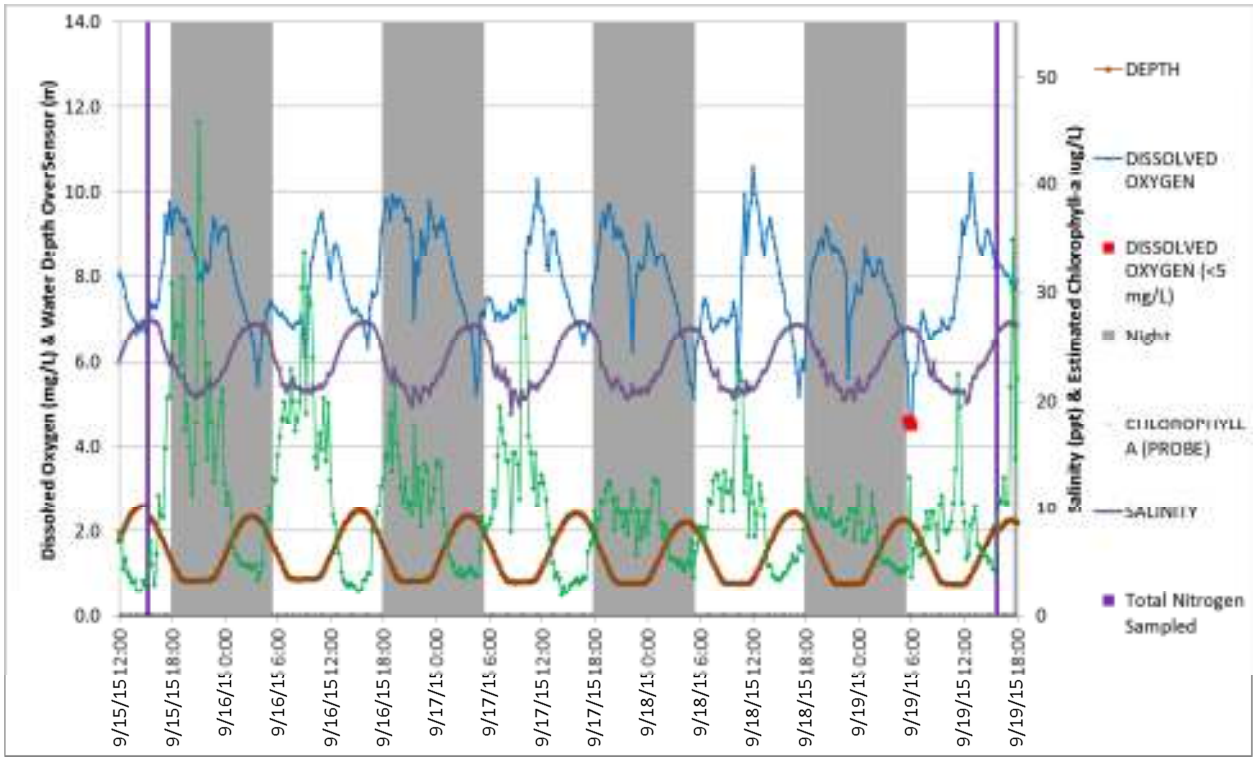
PERIOD 2



PERIOD 2

- Chlorophyll overgrowth begins to subside. Pulses of high chlorophyll seen only at low tide indicating that either the growth in the head of tide area take longer to flush out or that the head of tide area still grows water column algae.
- Dissolved oxygen begins to drop below 100%.
- Nightly respiration is a bit lower than the first period but without the elevated starting point, dissolved oxygen excursions below 5 mg/L begin to become frequent.
- Dissolved oxygen below 5 mg/L occurs at several early morning low tides.
- Salinity was relatively constant between 23-28ppt.
- Total nitrogen sampled at low tide on 9/9/2015 =447 ug/L.
- Total nitrogen sampled at high tide on 9/12/2015 = 376 ug/L.
- No total nitrogen samples collected in this period above the head of tide dam.
- Water temperature fell from 25C to 20C.
- Inflow based on #01072800 fell from 0.10 to 0.09 then rose to 0.20 cfsm (21st to 53rd percentile for the month (1995-2016)).

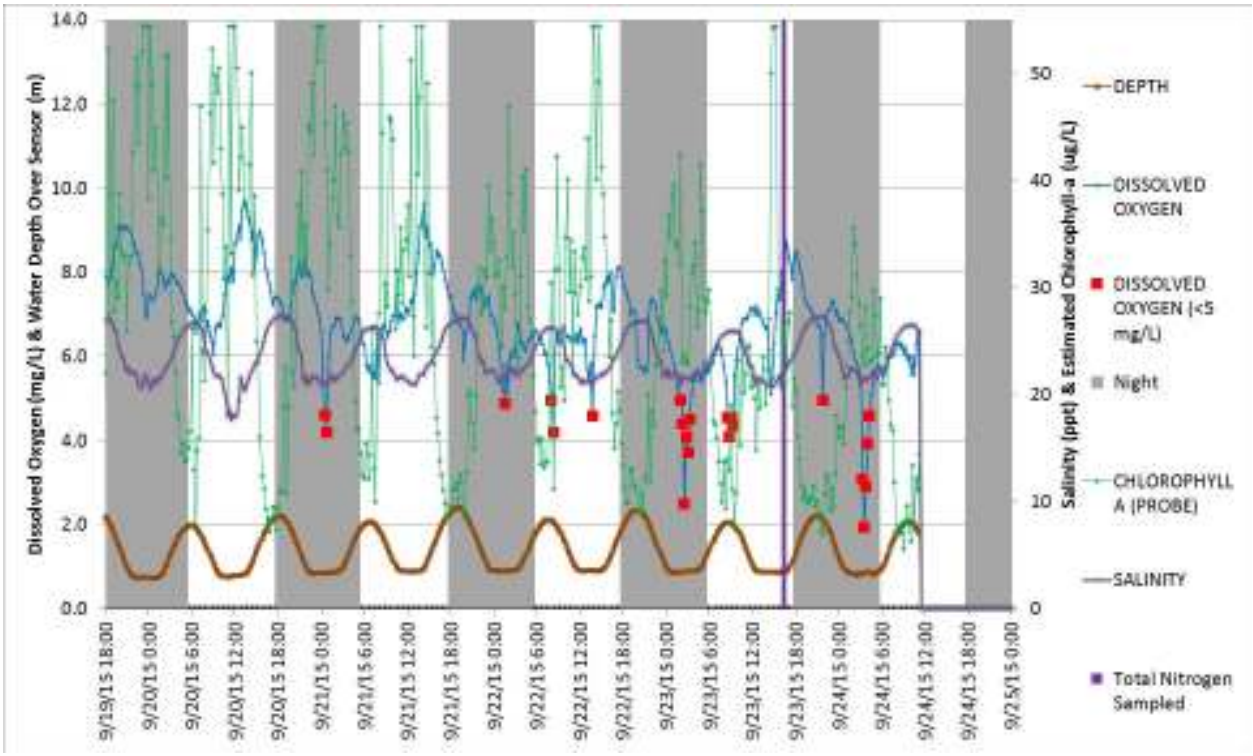
PERIOD 3



PERIOD 3

- Chlorophyll overgrowth drops even more, either die-off or washing out.
- Dissolved oxygen recovers.
- Typical saturation 70-135%.
- Salinity was relatively constant between 20-27ppt.
- Total nitrogen sampled at high tide on 9/15/2015 = 292 ug/L.
- Total nitrogen sampled at high tide on 9/19/2015 = 355 ug/L.
- No total nitrogen samples collected in this period above the head of tide dam.
- Water temperature started at 21 and rose to 23C.
- Inflow based on #01072800 fell 0.20 to 0.14 cfsm (51st to 37th percentile for the month (1995-2016)).

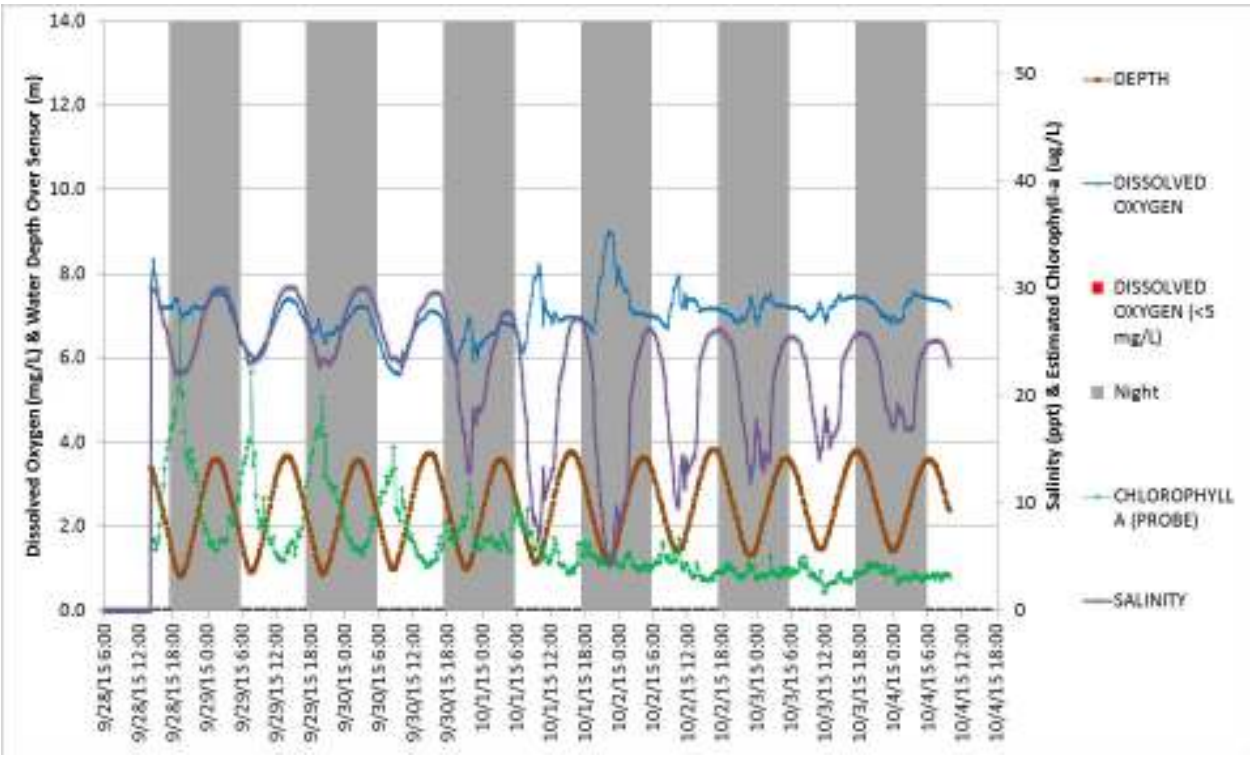
PERIOD 4



PERIOD 4

- Accelerated version of Periods 1&2.
- Chlorophyll growth then pulses of high chlorophyll seen only at low tide.
- Dissolved oxygen of 80-140% in first days, then drops.
- Nightly respiration is a bit lower than the first period but without the super-saturation starting point, dissolved oxygen excursions below 5 mg/L occur.
- Dissolved oxygen less than 5 mg/L occurs during the low tides and principally at night and early morning hours.
- Salinity is relatively constant between 23-28 ppt.
- Total nitrogen sampled at low tide on 9/23/2015 = 660 ug/L.
- Total nitrogen sampled above the head of tide dam, 9/23/2015= 536 ug/L.
- Water temperature started at 22C and fell to 19C.
- Inflow based on #01072800 fell from 0.13 to 0.11 cfsm (36th to 25th percentile for the month (1995-2016)).

PERIOD 5



PERIOD 5

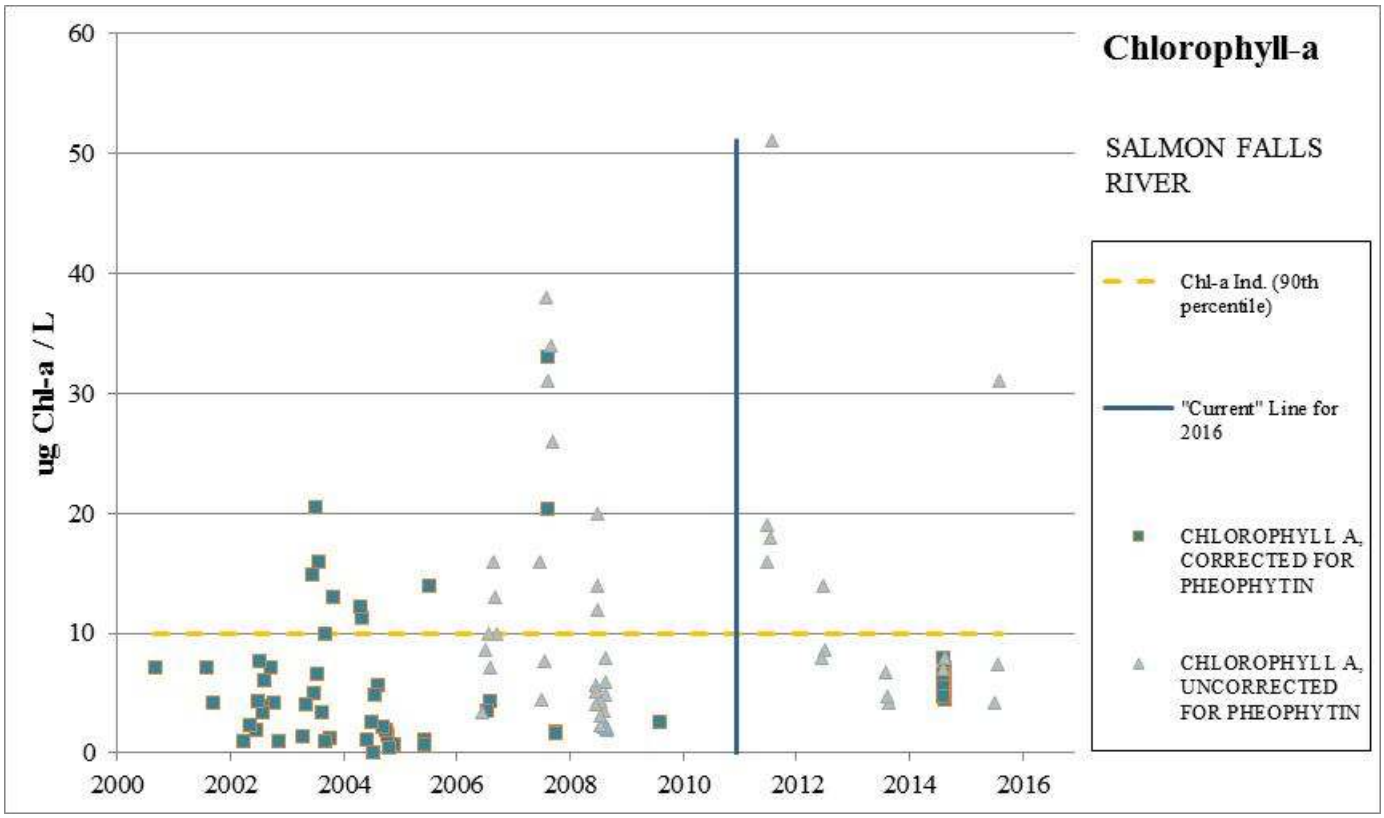
- Chlorophyll growth drops even more. Die-off or washed out.
- Higher chlorophyll seen only at low tide.
- Part way through period the freshwater inputs increase, flushing system.
- Saturation swings from 75-95%.
- Salinity runs 22-30ppt the drops to a range of 5/15 to 25 ppt.
- No total nitrogen samples taken above the head of tide dam in this period, however, on 10/28/2015 TN = 583 ug/L.
- Water temperature 18C falling to 15C.
- Inflow based on #01072800 was 0.08 cfsm, rose to 3.37 cfsm and then fell to 0.78 cfsm (18th, 92nd, and 63rd percentile for the month (1995-2016) respectively).
- Dissolved oxygen remained above 5 mg/L after this period.

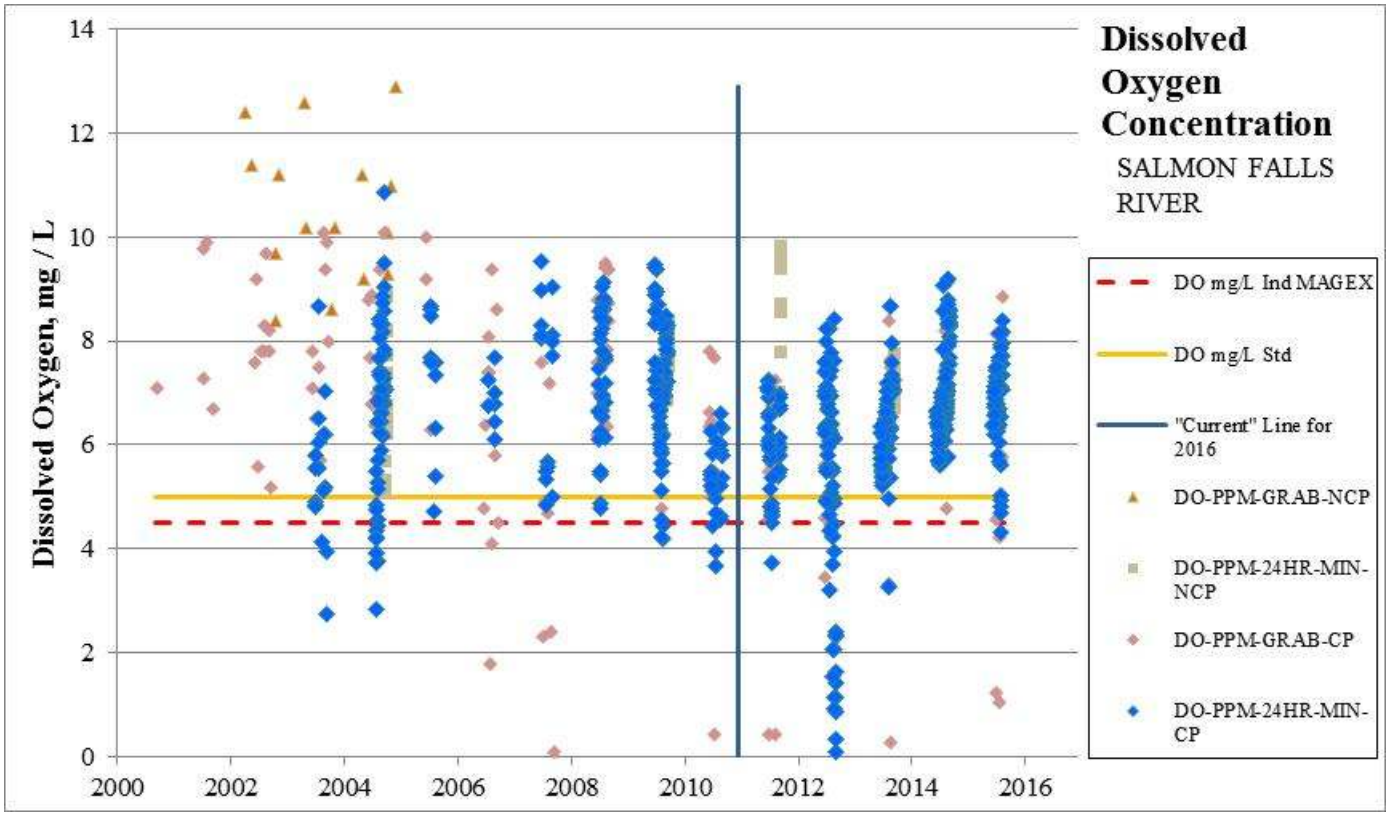
Cocheco River Assessment Zone	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	23	0.7	7.2	**14.6**	28.9
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	23	0.2	2.5	24.8	45.0
CHLOROPHYLL A, combined	46	0.2	5.0	14.6	45.0
DO-PERC-24H-MEAN-CP	145	74.7	92.9	117.5	130.8
DO-PERC-24H-MEAN-NCP	56	80.6	88.0	91.3	93.1
DO-PERC-2TIDE-GRAB-CP	0	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP	1	93.5	93.5	-	93.5
DO-PPM-24HR-MIN-CP	163	2.0	6.3	7.5	8.2
DO-PPM-24HR-MIN-NCP	58	5.8	8.4	9.3	9.7
DO-PPM-GRAB-CP	29	5.9	7.3	8.1	8.6
DO-PPM-GRAB-NCP	1	10.7	10.7	-	10.7
LIGHT ATTENUATION COEFFICIENT	19	0.760	**1.180**	1.740	2.200
TURBIDITY	122	0.2	5.2	20.8	1,222.0
Day Ave of TN	38	253	**488**	802	1,580
Day Ave of TDN	15	167	241	407	431
Day Ave of DIN (NH3 + NO2/3)	39	7	121	237	889
Day Ave of NH3	40	3	34	70	500
Day Ave of PON	12	35	111	446	488
Day Ave of NO2/3	39	2	80	181	816

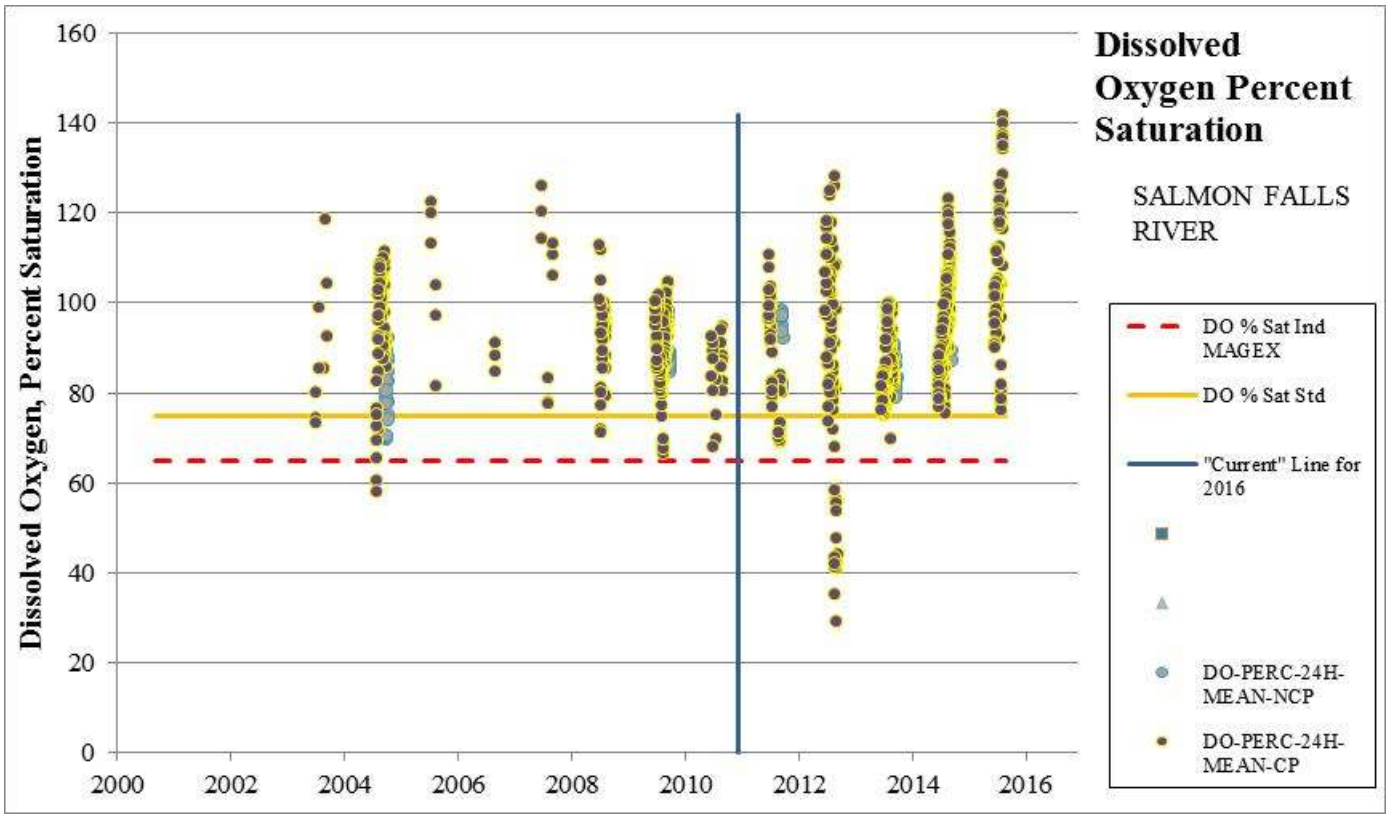
Assessment Zone = SALMON FALLS RIVER

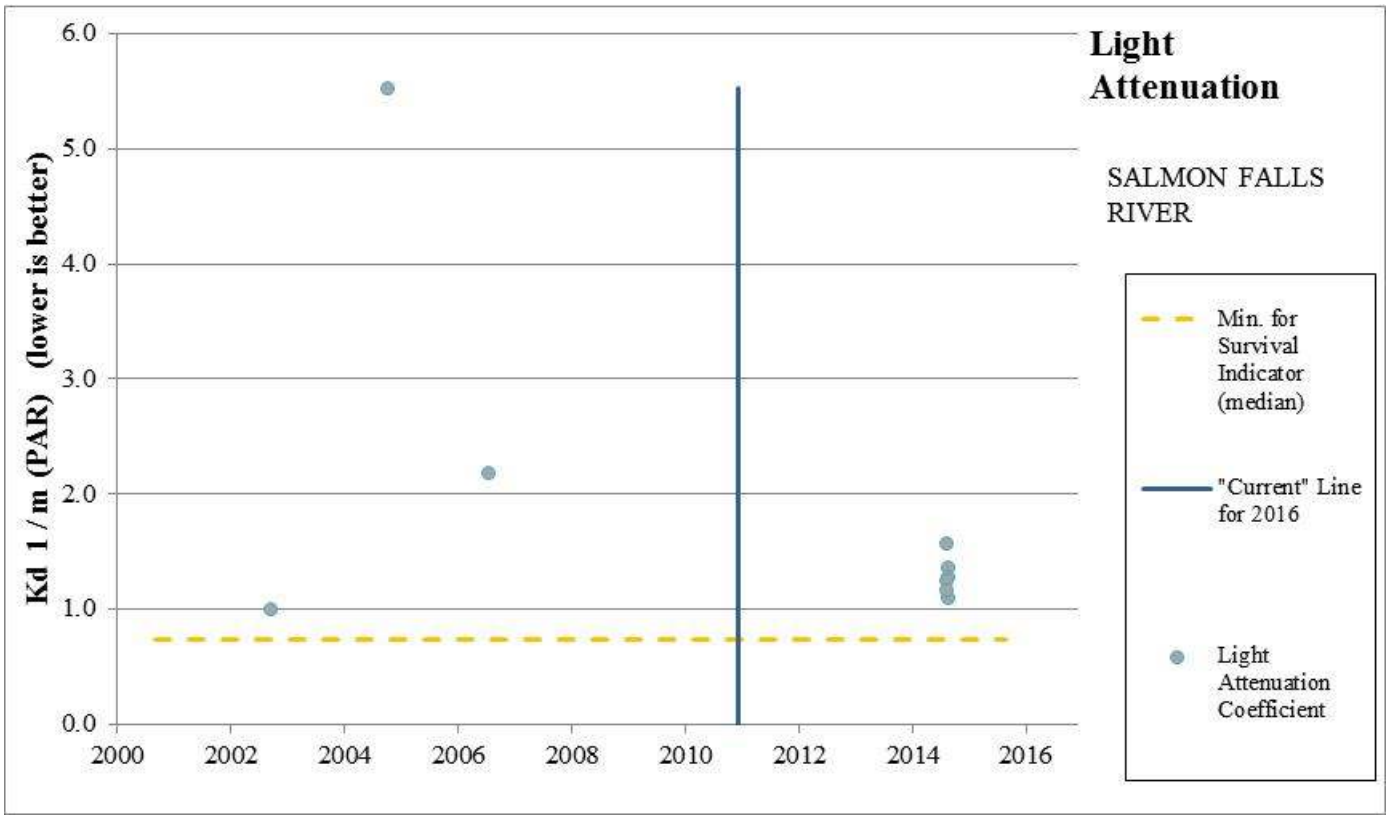
(NHEST600030406-01)

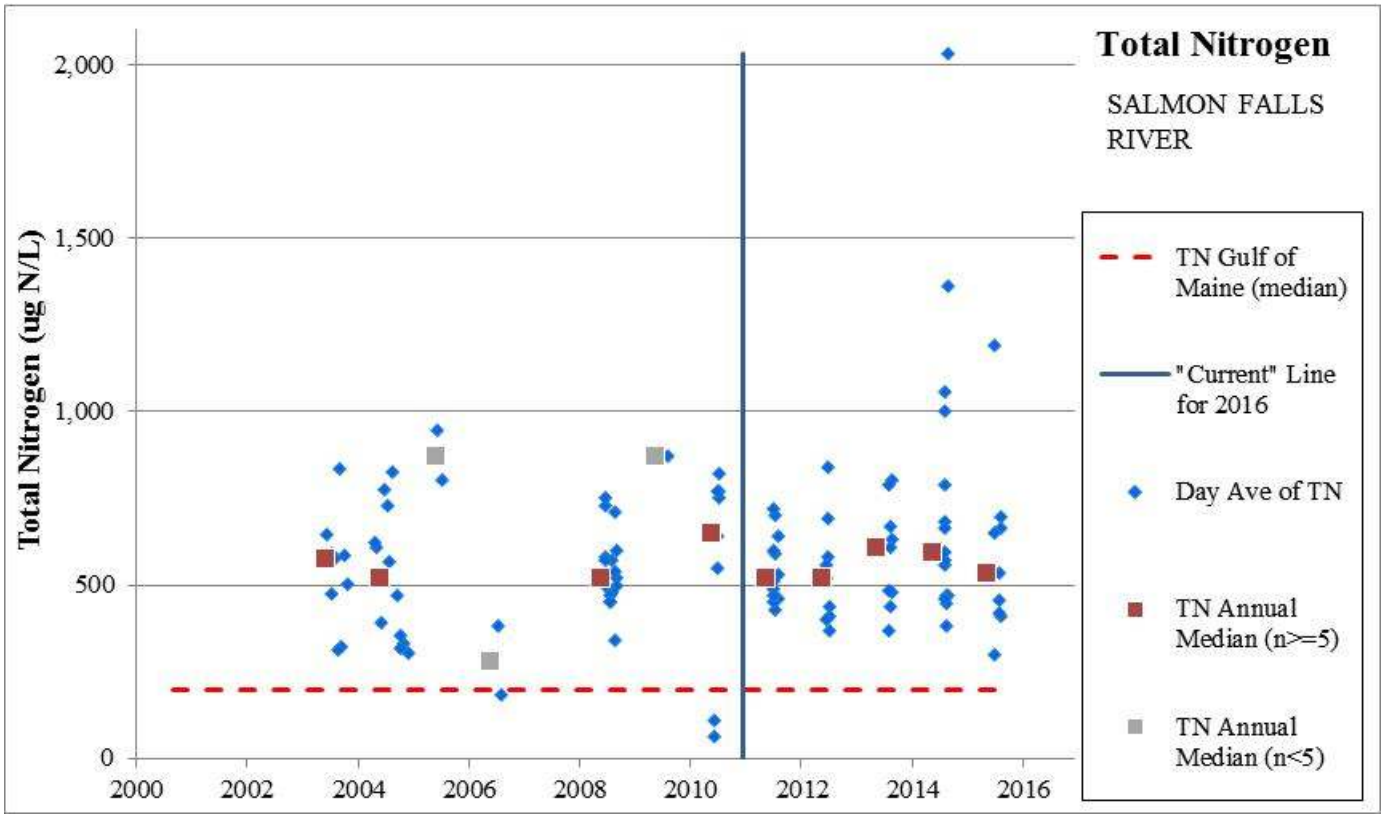
Indicator	Aquatic Life Use Category 2014 / 2016	2016 Comment
Chlorophyll-a	5-P / 5-P	The calculated 90th percentile chlorophyll-a in this assessment zone is 26.2 ug/L (n = 23) and a maximum reading of 51 ug/L. The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. Additionally, there are still frequent dissolved oxygen concentration and percent saturation criteria exceedences.
Dissolved Oxygen (mg/L)	5-P / 5-P	Dissolved oxygen concentration measurements in this assessment zone fall below the 5 mg/L criteria every year. In most years a portion of those measurements fall below 4 mg/L and in 2012 there were many measurements below 1 mg/L, as such, this impairment is considered severe.
Dissolved Oxygen (% Saturation)	5-P / 5-M	Dissolved oxygen 24 hour average percent saturation measurements in this assessment zone fall below the 75 percent criteria every year. In 2012 many of the datalogger based 24 hour averages were below 50 percent, as such, this impairment is considered severe.
Estuarine Bioassessments (eelgrass)	No Std / No Std	Not applicable. Eelgrass habitat has not historically existed in this assessment zone.
Water Clarity (Light Attenuation Coefficient)	No Std / No Std	Not applicable. The water clarity has not been assessed because eelgrass has not historically existed in this assessment zone.
Total Nitrogen	5-M / 5-M	The median total nitrogen from 2011 through 2015 was 560 ug/L (n=54). This assessment zone experiences frequent dissolved oxygen concentrations well below 5 mg/L and daily average saturation below 75 percent. During multiple years this assessment zone also demonstrated super saturation well over 125% The chlorophyll-a concentration 90th percentile was 26.2 ug/L (n = 23) and a maximum reading of 51 ug/L. Many of the classic indicators of nutrient eutrophication are present in this assessment zone. As such, the impairment for nitrogen has been retained.


Chlorophyll-a
SALMON FALLS RIVER
ug Chl-a / L
60
50
40
30
20
10
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
Chl-a Ind. (90th percentile)
"Current" Line for 2016
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN


Dissolved Oxygen Concentration
SALMON FALLS RIVER
Dissolved Oxygen, mg / L
14
12
10
8
6
4
2
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2016
DO-PPM-GRAB-NCP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-24HR-MIN-CP


Dissolved Oxygen Percent Saturation
SALMON FALLS RIVER
Dissolved Oxygen, Percent Saturation
160
140
120
100
80
60
40
20
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2016
DO-PERC-24H-MEAN-NCP
DO-PERC-24H-MEAN-CP


Light Attenuation
SALMON FALLS RIVER
Kd 1 / m (PAR) (lower is better)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
Min. for Survival Indicator (median)
"Current" Line for 2016
Light Attenuation Coefficient



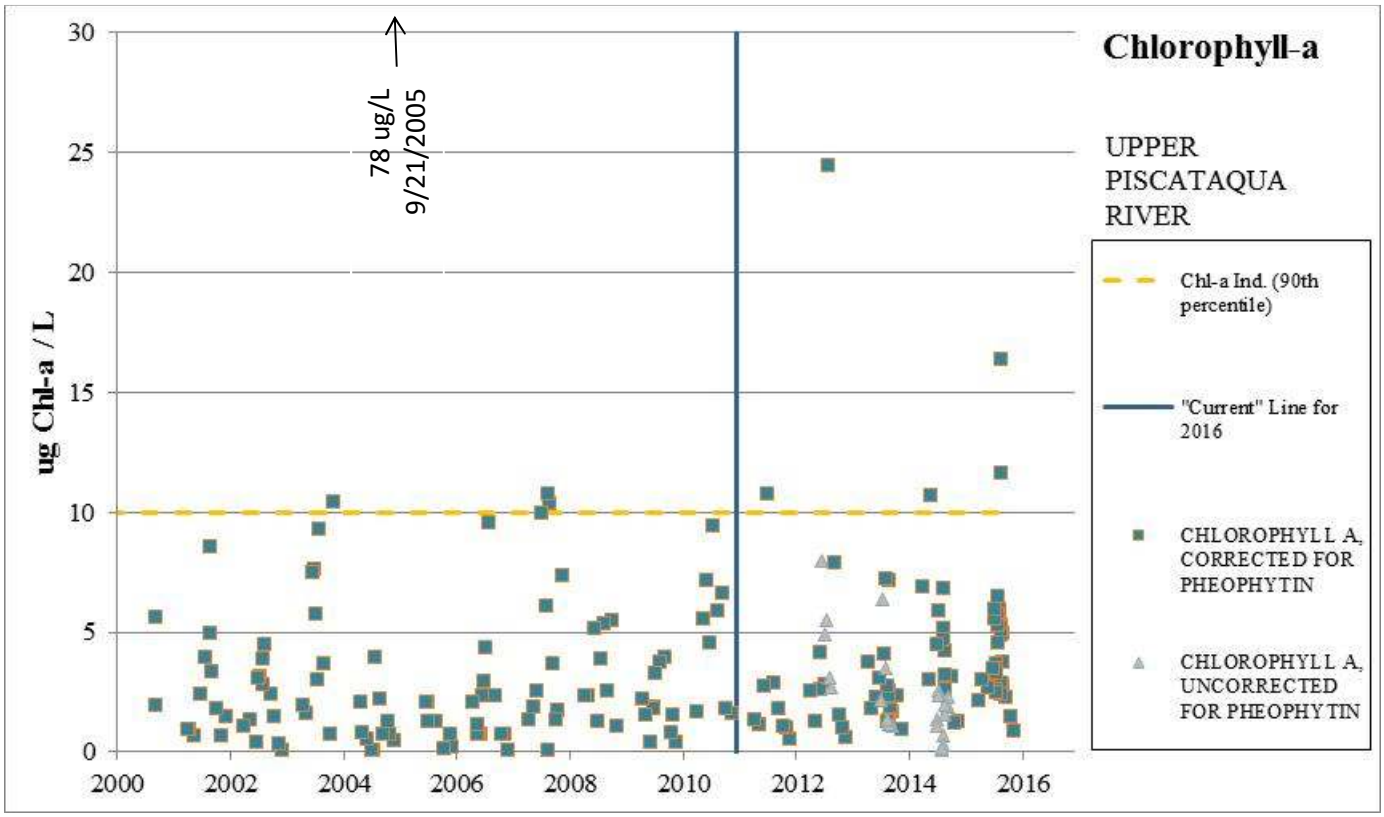
Salmon Falls River Assessment Zone	Count	Minimum	Median	90th Percentile	Maximum
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	8	4.5	5.8	-	7.9
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	15	4.2	8.0	39.0	51.0
CHLOROPHYLL A, combined	23	4.2	7.2	26.2	51.0
DO-PERC-24H-MEAN-CP	367	29.4	92.9	113.4	141.9
DO-PERC-24H-MEAN-NCP	26	79.3	87.7	97.7	98.5
DO-PERC-2TIDE-GRAB-CP	0	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP	0	-	-	-	-
DO-PPM-24HR-MIN-CP	379	0.1	6.5	7.9	9.2
DO-PPM-24HR-MIN-NCP	30	6.7	7.3	9.7	9.8
DO-PPM-GRAB-CP	52	0.3	6.6	8.2	9.1
DO-PPM-GRAB-NCP	0	-	-	-	-
LIGHT ATTENUATION COEFFICIENT	6	1.108	**1.279**	-	1.580
TURBIDITY	393	0.0	3.4	29.1	417.6
Day Ave of TN	54	300	**560**	922	2,034
Day Ave of TDN	0	-	-	-	-
Day Ave of DIN (NH3 + NO2/3)	53	60	201	409	689
Day Ave of NH3	54	5	99	195	251
Day Ave of PON	0	-	-	-	-
Day Ave of NO2/3	53	30	124	282	491

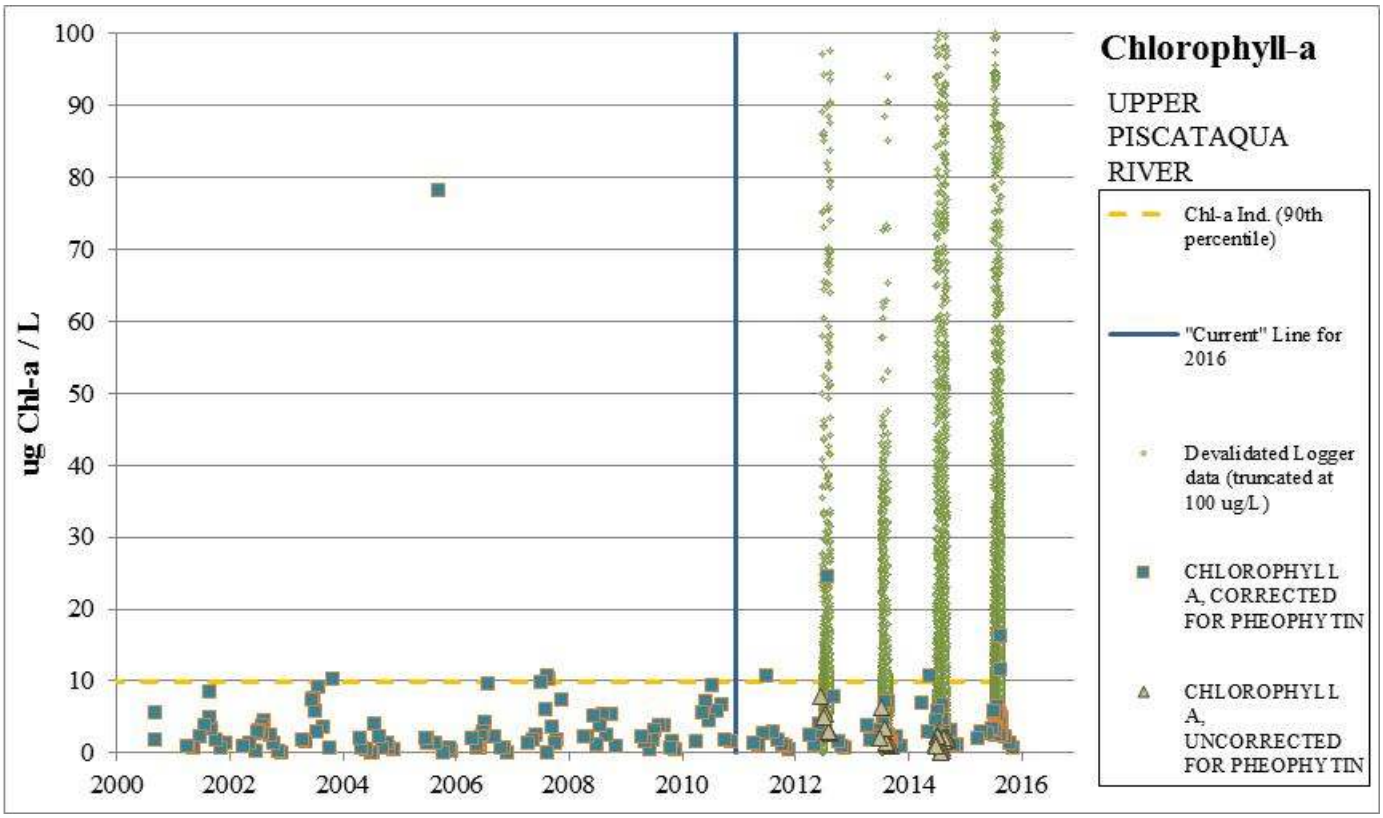
Assessment Zone = UPPER PISCATAQUA RIVER

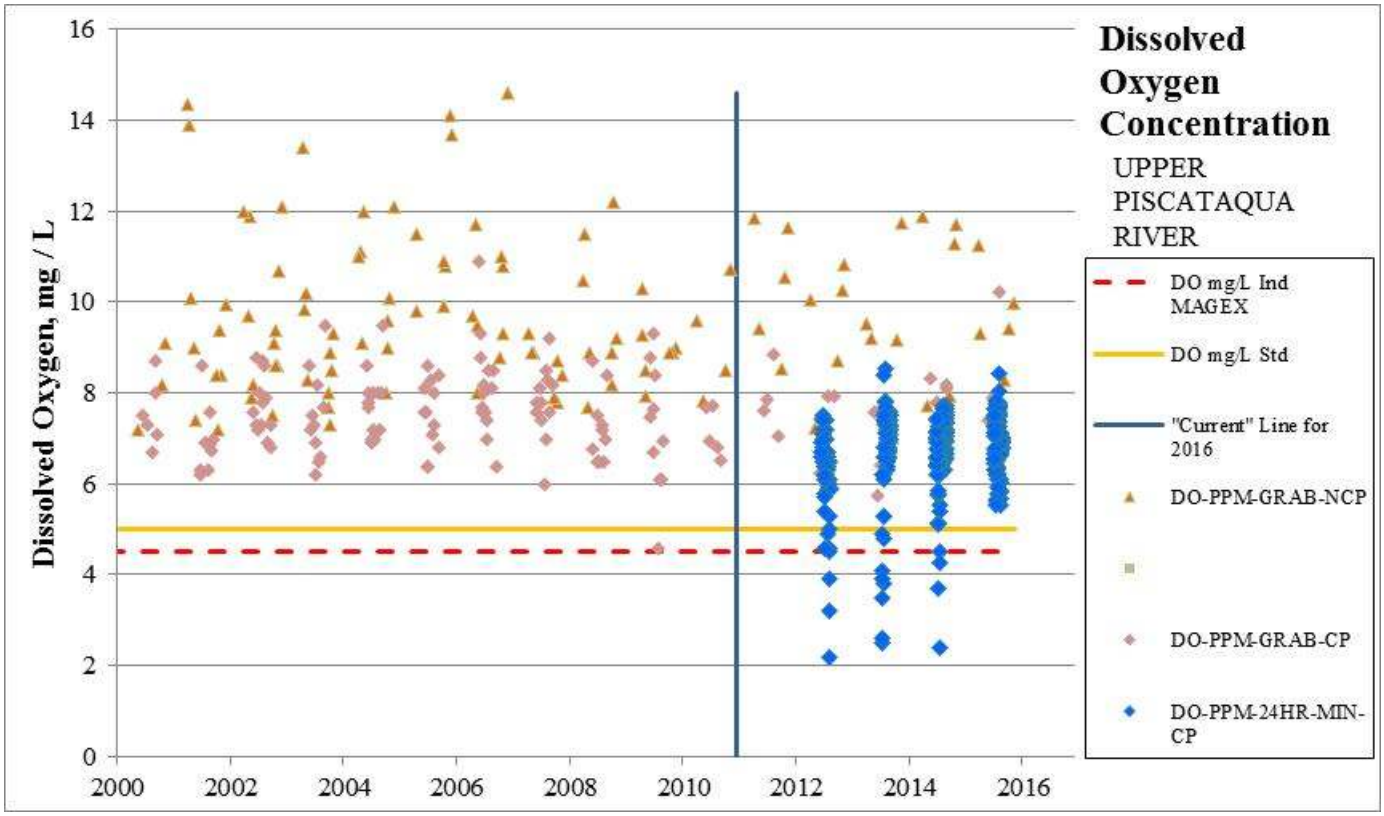
(NHEST600031001-01-01, NHEST600031001-01-02, NHEST600031001-01-03)

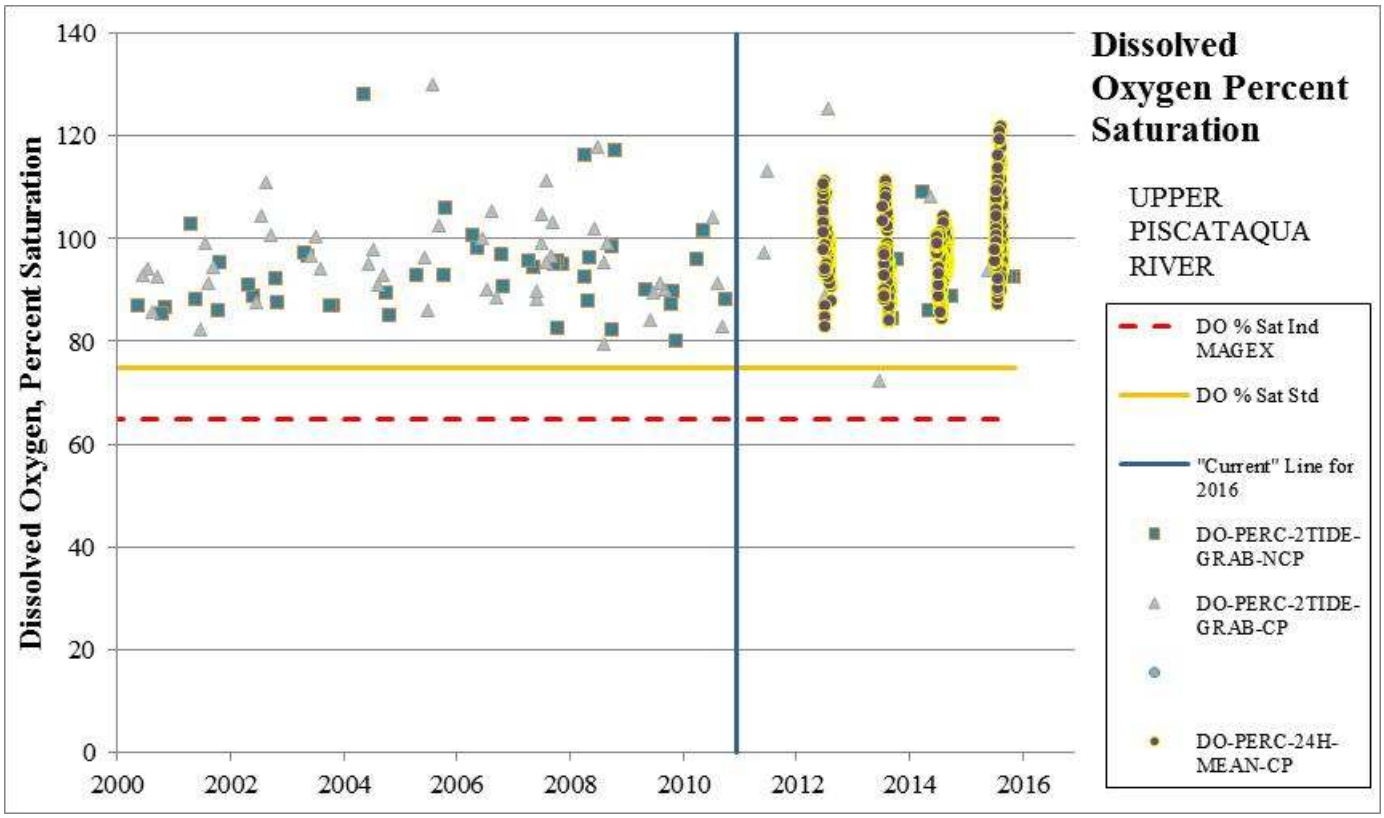
Indicator	Aquatic Life Use Category 2014 / 2016	2016 Comment
Chlorophyll-a	2-M / 2-M	The calculated 90th percentile chlorophyll-a in this assessment zone is 7.1 ug/L (n = 106) and a maximum reading of 24.5 ug/L. Although the probe based chlorophyll-a data (not used in the median above) collected from the UPR stations was qualified as "estimated" due to poor correlation between probe and extracted chlorophyll-a grab sample data, the relative biomass is valid and shows severe spikes in chlorophyll-a. The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L.
Dissolved Oxygen (mg/L)	3-PNS / 3-PNS	Before 2012, only grab samples of dissolved oxygen had been collected in the Upper Piscataqua River assessment zone. In the case of this assessment zone there are 383 station/days of datalogger DO readings during the critical summer period. From that overall dataset we see that from 2012 to 2014 there were 19 days on which DO fell below 5 mg/L for 0.25 to 2.75 hours; there were 10 days on which DO fell below 4 mg/L for 0.25 to 2.25 hours; and there were four days on which DO fell below 3 mg/L for 0.25 to 0.5 hours. While similar to the Cocheco River, these low DO events are both less frequent and of lower magnitude than was seen in the Cocheco River. The frequency, duration, and magnitude of those dips have not risen to the severity that warrants and impairment. Further, the 52-day 2015 dataset demonstrated that dissolved oxygen always stayed above 5.5 mg/L , in contrast to the same months (August and September) in 2012 through 2014, and under slightly warmer conditions that the earlier time period. Acknowledging the existing data, this assessment zone is being assessed as potentially not supporting the dissolved oxygen indicator.
Dissolved Oxygen (% Saturation)	2-G / 2-G	This assessment zone has only grab sample measurements for dissolved oxygen 24 hour average percent saturation through 2011. In 2012 through 2015 dataloggers were deployed and no 24 hour averages fell below 75 percent. The available data indicates that this assessment zone meets the dissolved oxygen saturation criteria.
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 79.7 acres from the 1948, 1962, 1980, and 1981 datasets. The median current extent of eelgrass in 2014-2016 is 0 acres, which is a decrease of 100%. Since 1990, the trend in eelgrass cover in this assessment zone is a loss of 69.9%. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	5-P / 5-P	Median=1.025 m^-1 (n=81). For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1. This assessment zone historically had eelgrass growing in both the shallows and some in deeper habitat making the 2m restoration depth a valid target. Therefore, the impaired (5-P) listing from the 2014 303d list has been retained.
Total Nitrogen	3-PNS / 3-PNS	The median total nitrogen from 2011 through 2015 was 363 ug/L (n=94). While the Dissolved oxygen data shows that this assessment zone experiences short duration concentrations below the 5 mg/L criteria, they do not support an impairment determination for DO. The 24 hour average dissolved oxygen percent saturation did not fall below 75% in the available dataset. The calculated 90th percentile chlorophyll-a in this assessment zone is 7.1 ug/L (n = 106) and a maximum reading of 24.5 ug/L. Although the probe-based chlorophyll-a data (not used in the median above) collected from the UPR stations was qualified as "estimated" per USEPA, due to poor correlation between probe and extracted chlorophyll-a grab sample data, the relative biomass is valid and shows large spikes in chlorophyll-a under certain conditions. The grab sample-based light attenuation (median=1.025 m^-1 (n=81)) is quite poor suggesting strong resuspension in the system. For shallow systems, it is expected that changes in macroalgae will precede changes in phytoplankton (McGlathery, Sundbäck, & Anderson, 2007) (Valiela, et al., 1997), as appears to be occurring in the Great Bay Estuary. The foremost authority on macroalgae for this estuary, Dr. Arthur C. Mathieson, commented on the draft 2012 303(d) that he remains

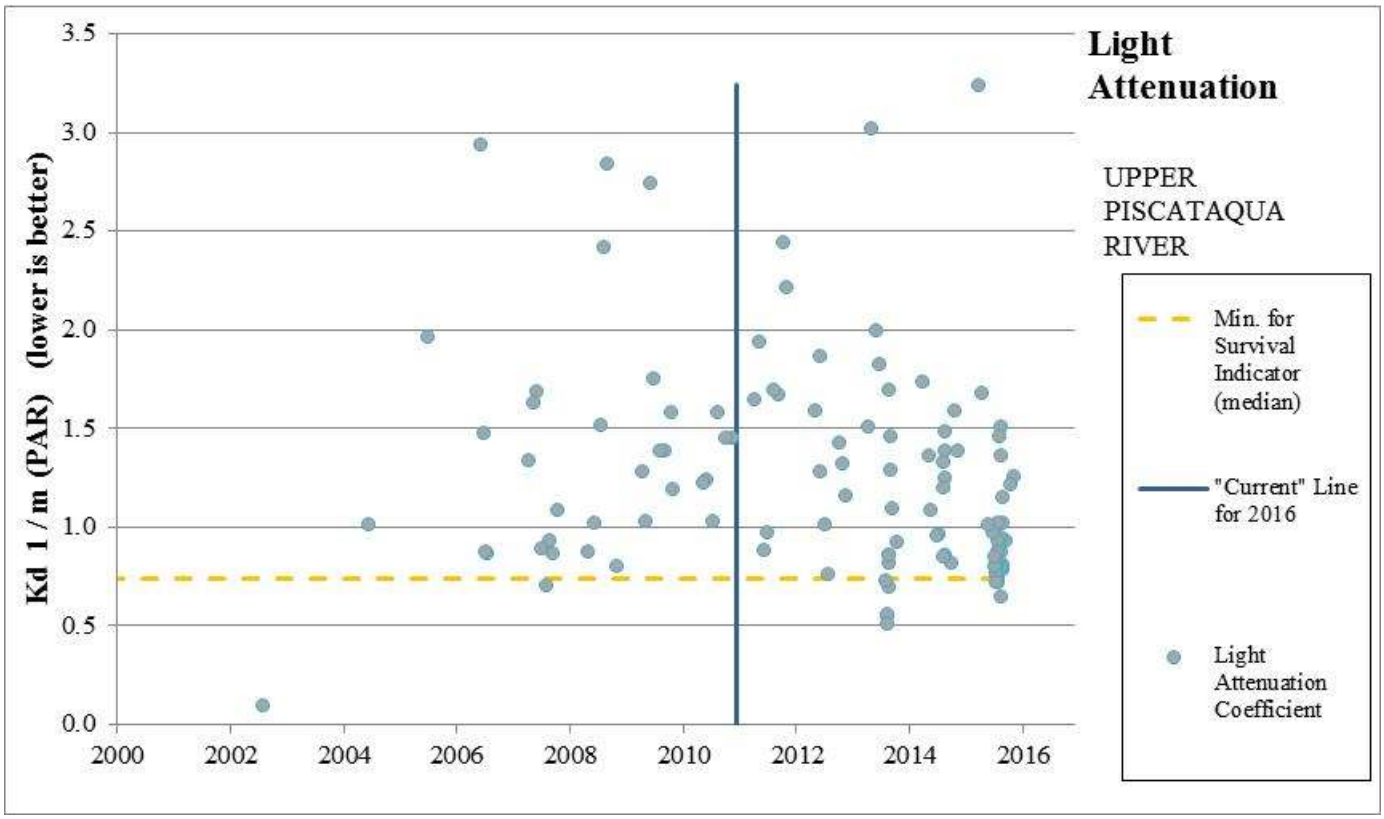
		concerned about the macroalgae and epiphyte conditions in Great Bay (NHDES, 2013). At this time there are some of the classic indicators of nutrient eutrophication present in this assessment zone and total nitrogen remains high. However, there are insufficient response datasets to determine that the eutrophication by total nitrogen alone is not known to be strong enough to warrant impairment under New Hampshire's narrative standard. Additionally, the nutrient load to this assessment zone is rapidly decreasing due to ongoing work by the municipalities (Rochester reductions in 2014 and Dover began reductions in 2015). As such, this assessment zone has been assessed as Insufficient Information – Potentially Not Supporting (3-PNS) for total nitrogen.

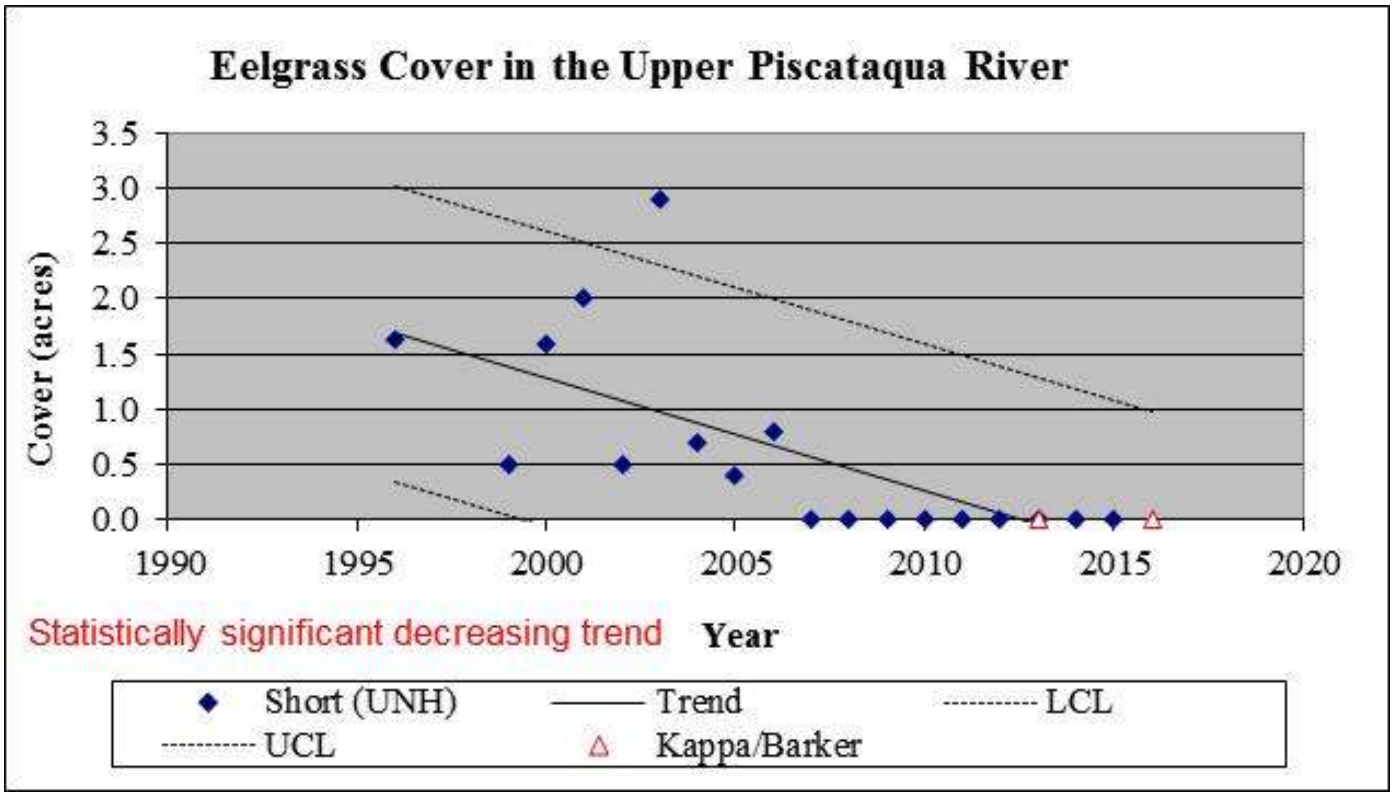


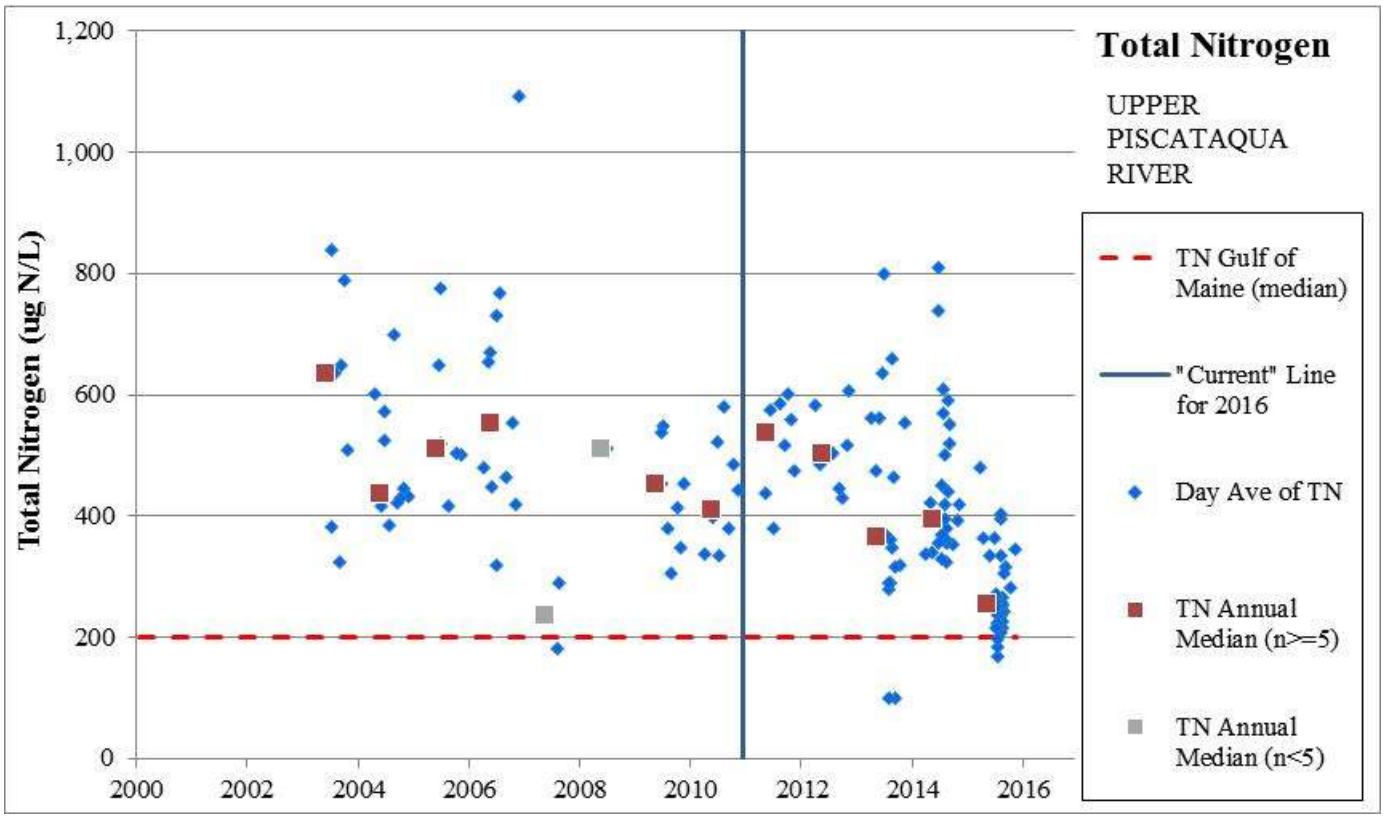

Chlorophyll-a
UPPER PISCATAQUA RIVER
ug Chl-a / L
Chl-a Ind. (90th percentile)
"Current" Line for 2016
Devalidated Logger data (truncated at 100 ug/L)
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN


Dissolved Oxygen Concentration
UPPER PISCATAQUA RIVER
Dissolved Oxygen, mg / L
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2016
DO-PPM-GRAB-NCP
DO-PPM-GRAB-CP
DO-PPM-24HR-MIN-CP


Dissolved Oxygen Percent Saturation
UPPER PISCATAQUA RIVER
Dissolved Oxygen, Percent Saturation
140
120
100
80
60
40
20
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2016
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP
DO-PERC-24H-MEAN-CP


Light Attenuation
UPPER PISCATAQUA RIVER
Kd 1 / m (PAR) (lower is better)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
Min. for Survival Indicator (median)
"Current" Line for 2016
Light Attenuation Coefficient


Eelgrass Cover in the Upper Piscataqua River
Cover (acres)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1990
1995
2000
2005
2010
2015
2020
Statistically significant decreasing trend
Year
Short (UNH)
Trend
LCL
UCL
Kappa/Barker

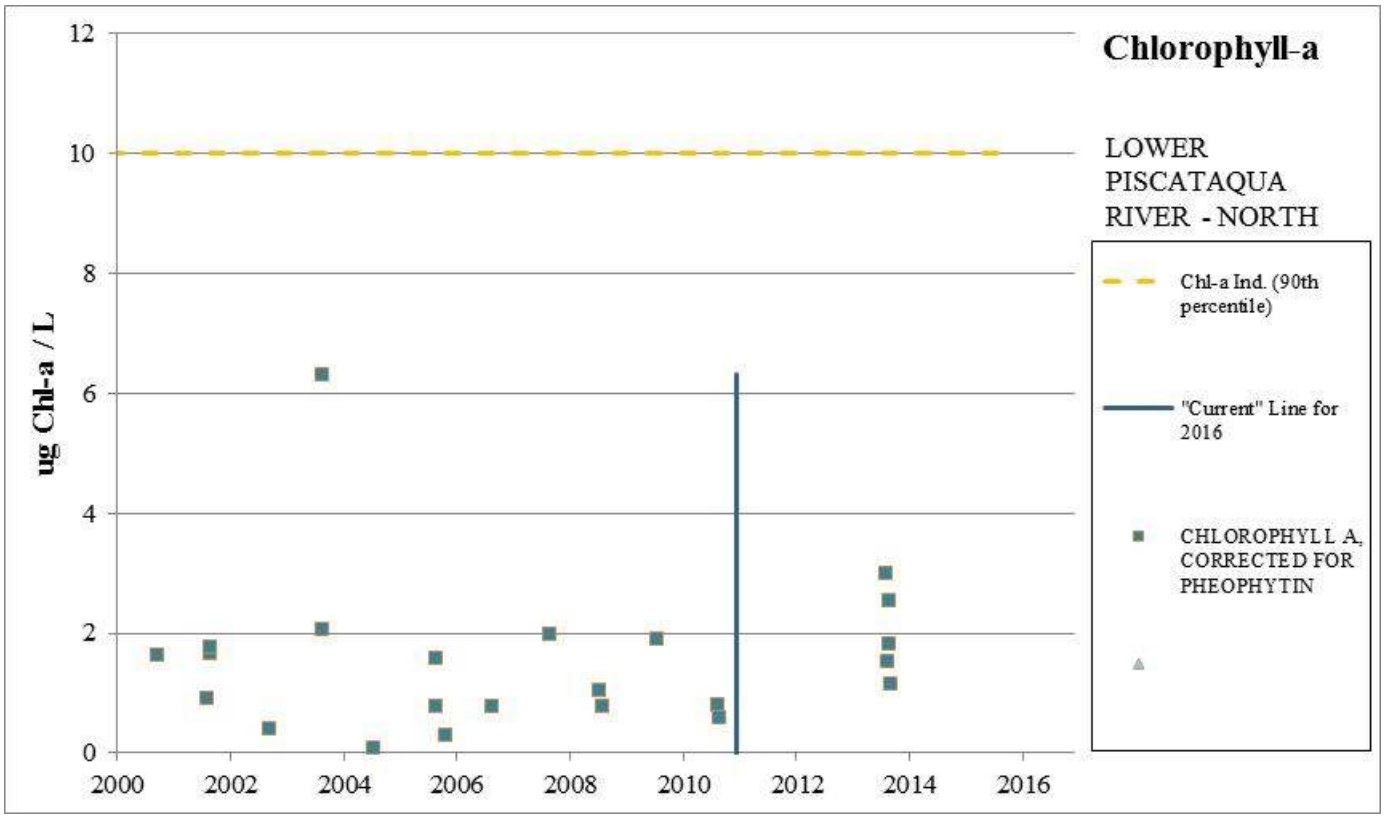

Total Nitrogen
UPPER PISCATAQUA RIVER
Total Nitrogen (ug N/L)
1,200
1,000
800
600
400
200
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
TN Gulf of Maine (median)
"Current" Line for 2016
Day Ave of TN
TN Annual Median (n>=5)
TN Annual Median (n<5)

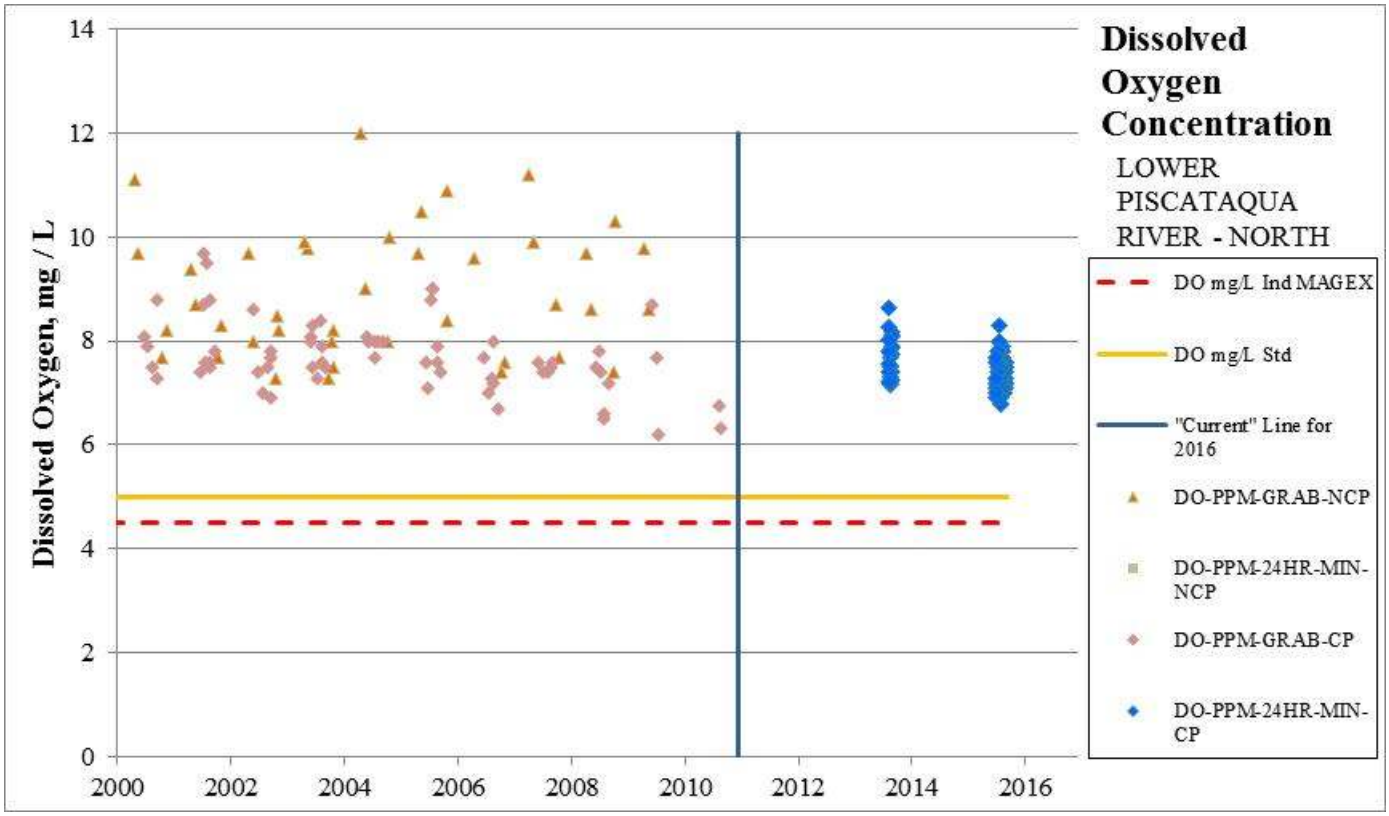
Upper Piscataqua River Assessment Zone	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	83	0.5	3.1	**7.1**	24.5
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	23	0.1	2.0	6.0	8.0
CHLOROPHYLL A, combined	106	0.1	2.8	7.1	24.5
DO-PERC-24H-MEAN-CP	353	83.0	95.8	108.5	122.0
DO-PERC-24H-MEAN-NCP	0	-	-	-	-
DO-PERC-2TIDE-GRAB-CP	10	72.5	97.1	124.4	125.5
DO-PERC-2TIDE-GRAB-NCP	8	84.6	92.7	-	109.2
DO-PPM-24HR-MIN-CP	383	2.2	6.9	7.5	8.6
DO-PPM-24HR-MIN-NCP	0	-	-	-	-
DO-PPM-GRAB-CP	34	5.7	7.3	8.4	10.2
DO-PPM-GRAB-NCP	25	7.0	9.5	11.8	11.9
LIGHT ATTENUATION COEFFICIENT	81	0.520	**1.025**	1.822	3.250
TURBIDITY	98	1.1	4.6	7.2	15.5
Day Ave of TN	94	100	**363**	596	810
Day Ave of TDN	72	121	267	482	551
Day Ave of DIN (NH3 + NO2/3)	96	5	127	268	425
Day Ave of NH3	98	3	33	68	500
Day Ave of PON	26	37	76	221	284
Day Ave of NO2/3	96	2	77	218	386

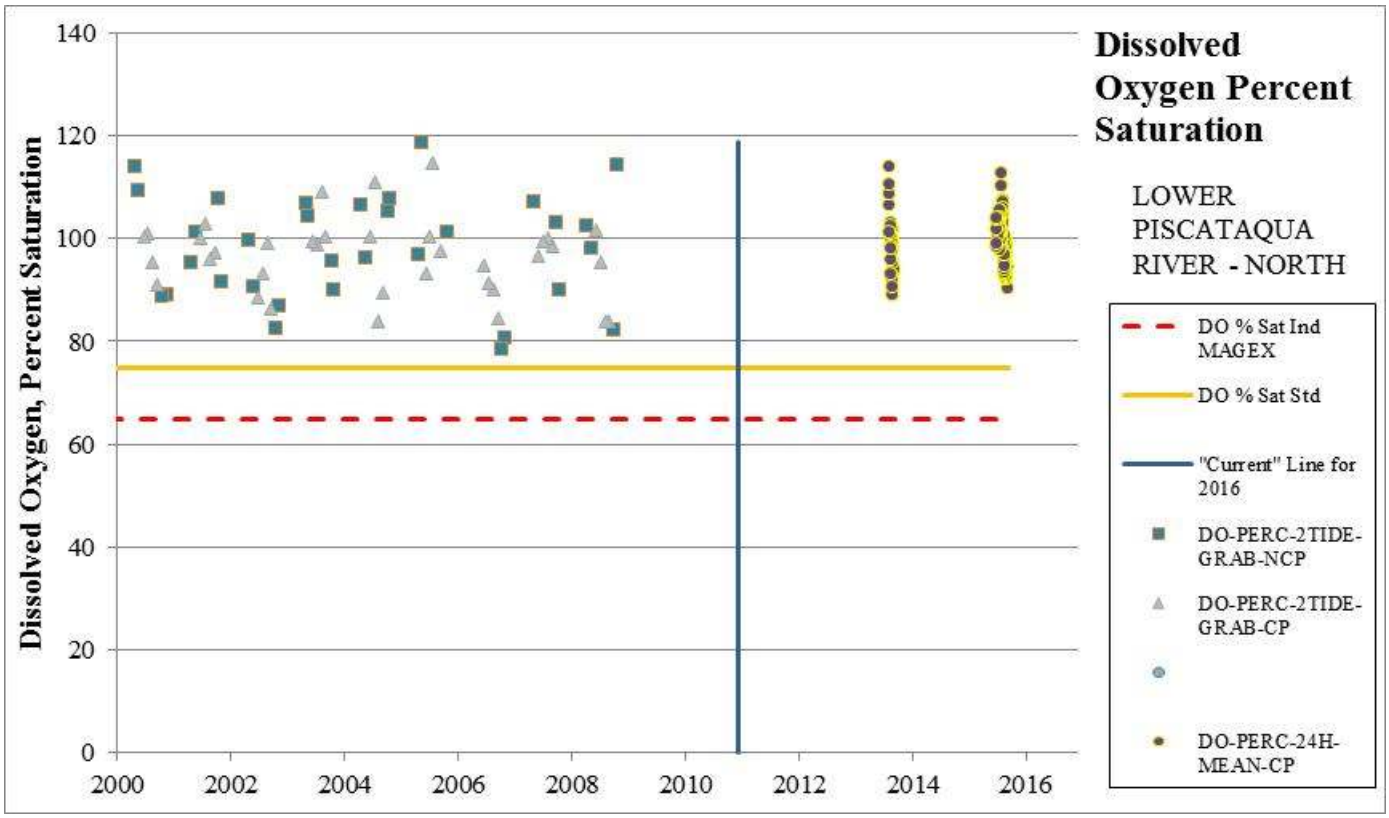
Assessment Zone = LOWER PISCATAQUA RIVER - NORTH

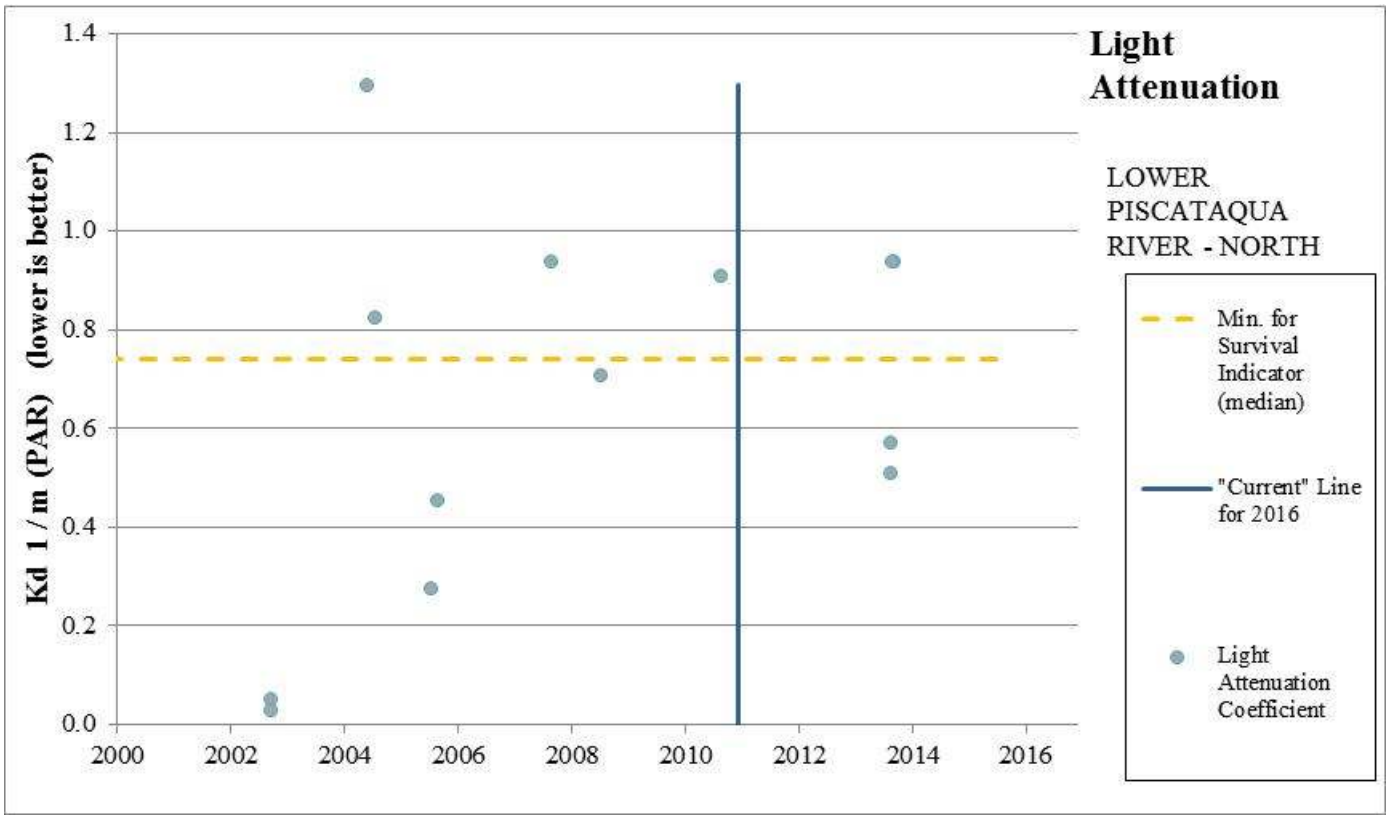
(NHEST600031001-02-01)

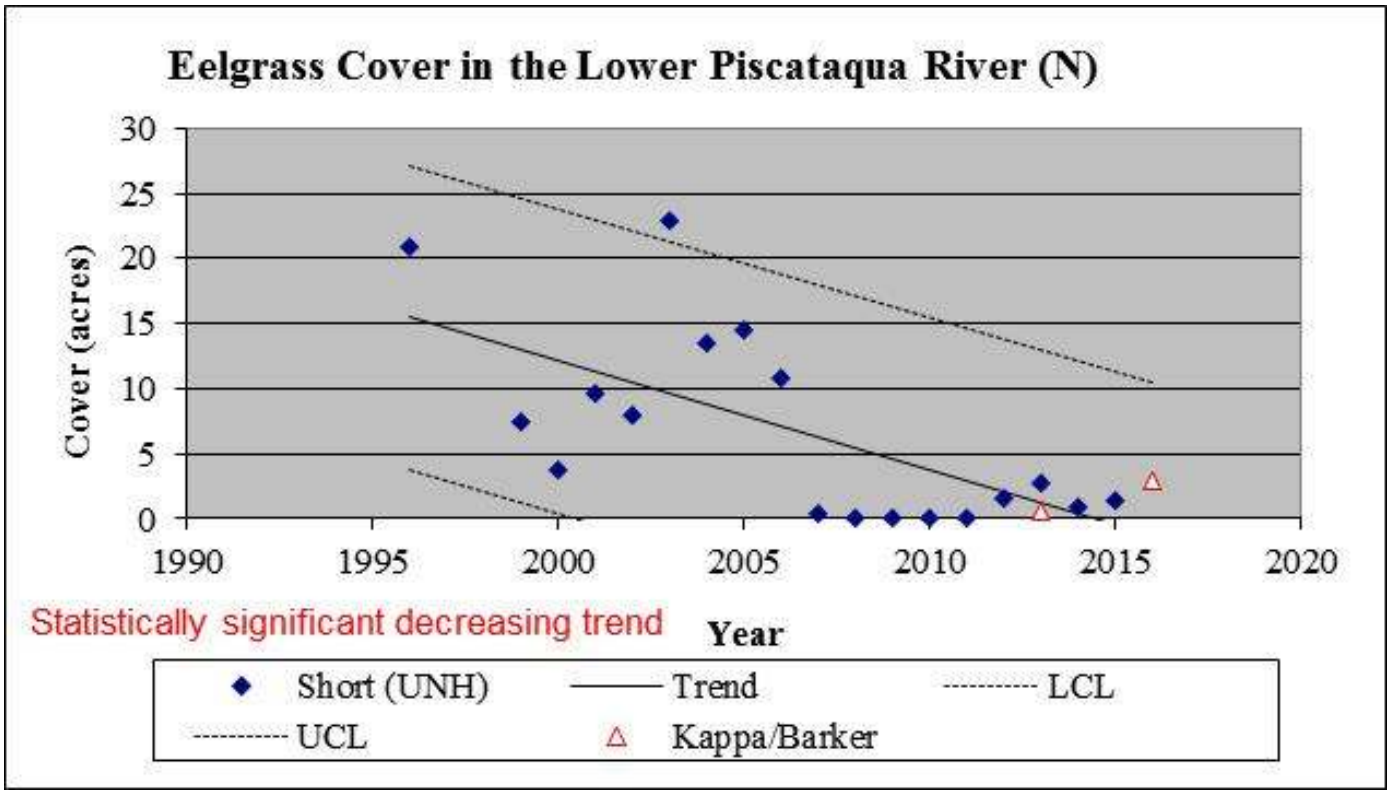
Indicator	Aquatic Life Use Category 2014 / 2016	2016 Comment
Chlorophyll-a	3-PAS / 3-PAS	The calculated 90th percentile chlorophyll-a in this assessment zone cannot be calculated due to the presence of only five measured values in since 2011 (1.2 to 3.0 ug/L). The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. The limited available data leads to an assessment of Insufficient Information – Potentially Attaining Standards.
Dissolved Oxygen (mg/L)	2-G / 2-G	This assessment zone had a datalogger deployment in 2013 and 2015. During those periods no dissolved oxygen concentration measurements fell below 5 mg/L. The available data indicates that this assessment zone meets the dissolved oxygen concentration criteria.
Dissolved Oxygen (% Saturation)	2-G / 2-G	This assessment zone had datalogger deployments in 2013 and 2015. During those periods no 24 hour averages fell below 75 percent. The available data indicates that this assessment zone meets the dissolved oxygen saturation criteria.
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 60.1 acres from the 1948, 1962, 1980, and 1981 datasets. The median current extent of eelgrass in 2014-2016 is 1.4 acres, which is a decrease of 97.7%. Since 1990, the trend in eelgrass cover in this assessment zone is a loss of 54.5%. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	3-PNS/ 3-PNS	Median=0.765 m^-1 (n=4). For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1. This assessment zone historically had eelgrass growing in both the shallows and deeper habitat making the 2m restoration depth a valid target. Therefore, the insufficient information – potentially not supporting (3-PNS) assessment from the 2014 305(b) assessment has been retained.
Total Nitrogen	3-PNS / 3-PAS	The median total nitrogen from 2011 through 2015 was 292 ug/L (n=2There are no documented dissolved oxygen concentration or saturation criteria exceedences in the available data. The limited chlorophyll-a data suggests that this assessment zone would meet chlorophyll-a indicator to protect dissolved oxygen. The eelgrass beds are severely degraded and the limited available light attenuation (median=0.765 m^-1 (n=4)) is poor. There are insufficient data to indicate that the eutrophication is strong enough to warrant a total nitrogen impairment. As such, the assessment zone has been assessed as insufficient information-potential attaining standards for nitrogen.

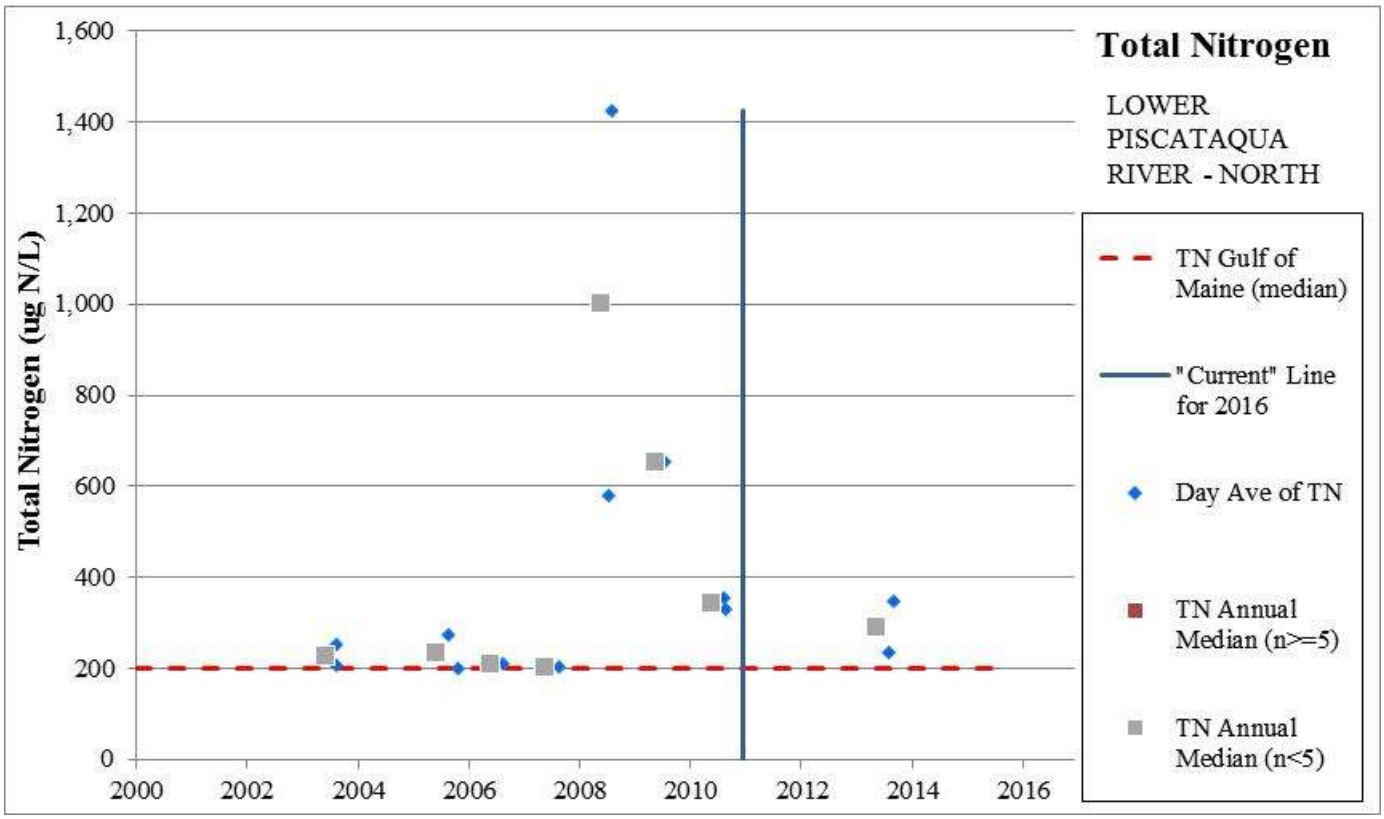

Chlorophyll-a
LOWER PISCATAQUA RIVER - NORTH
ug Chl-a / L
Chl-a Ind. (90th percentile)
"Current" Line for 2016
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN


Dissolved Oxygen Concentration
LOWER PISCATAQUA RIVER - NORTH
Dissolved Oxygen, mg / L
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2016
DO-PPM-GRAB-NCP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-24HR-MIN-CP


Dissolved Oxygen Percent Saturation
LOWER PISCATAQUA RIVER - NORTH
Dissolved Oxygen, Percent Saturation
140
120
100
80
60
40
20
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2016
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP
DO-PERC-24H-MEAN-CP


Light Attenuation
LOWER PISCATAQUA RIVER - NORTH
Kd 1 / m (PAR) (lower is better)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
Min. for Survival Indicator (median)
"Current" Line for 2016
Light Attenuation Coefficient


Eelgrass Cover in the Lower Piscataqua River (N)
Cover (acres)
30
25
20
15
10
5
0
1990
1995
2000
2005
2010
2015
2020
Statistically significant decreasing trend
Year
Short (UNH)
Trend
LCL
UCL
Kappa/Barker

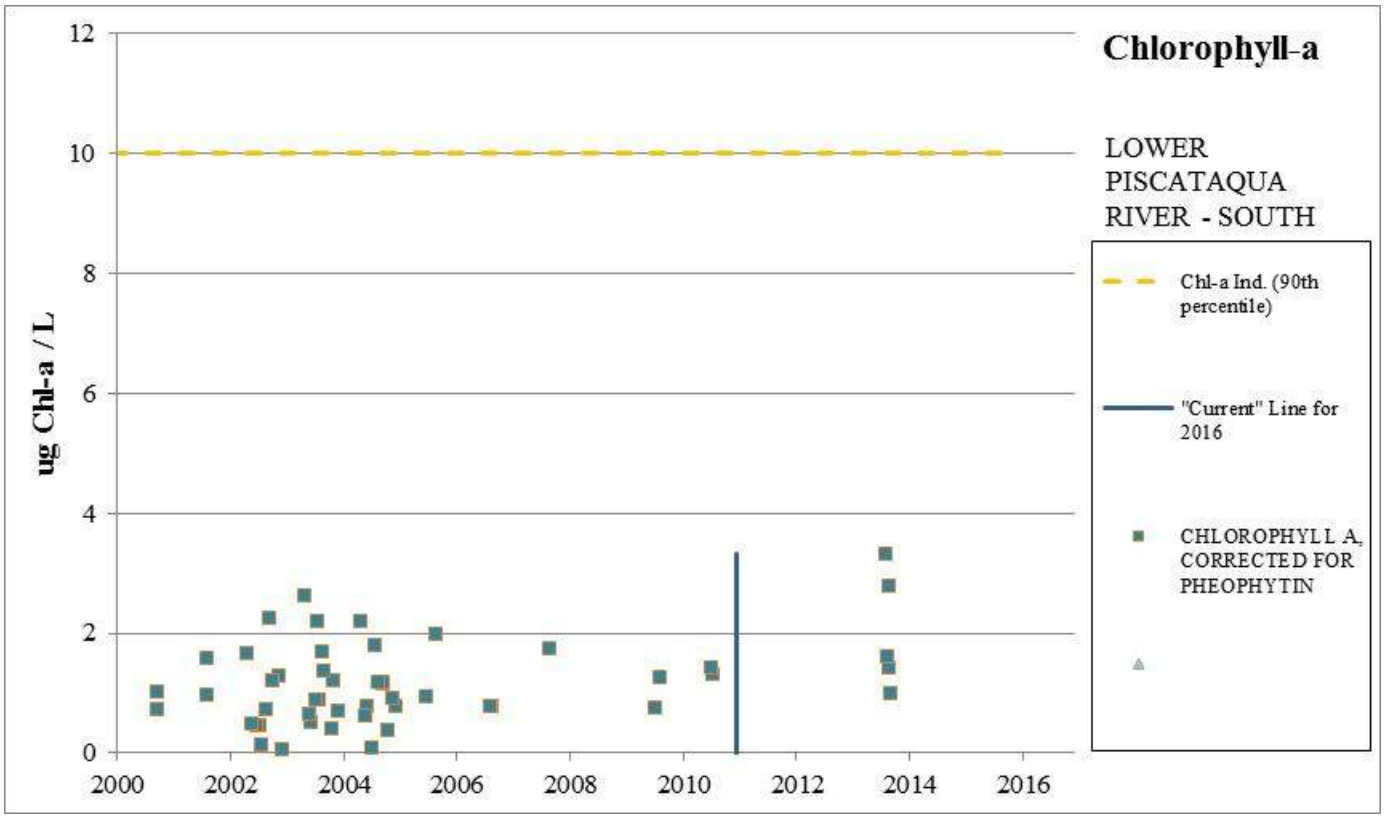

Total Nitrogen
LOWER PISCATAQUA RIVER - NORTH
Total Nitrogen (ug N/L)
1,600
1,400
1,200
1,000
800
600
400
200
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
TN Gulf of Maine (median)
"Current" Line for 2016
Day Ave of TN
TN Annual Median (n>=5)
TN Annual Median (n<5)

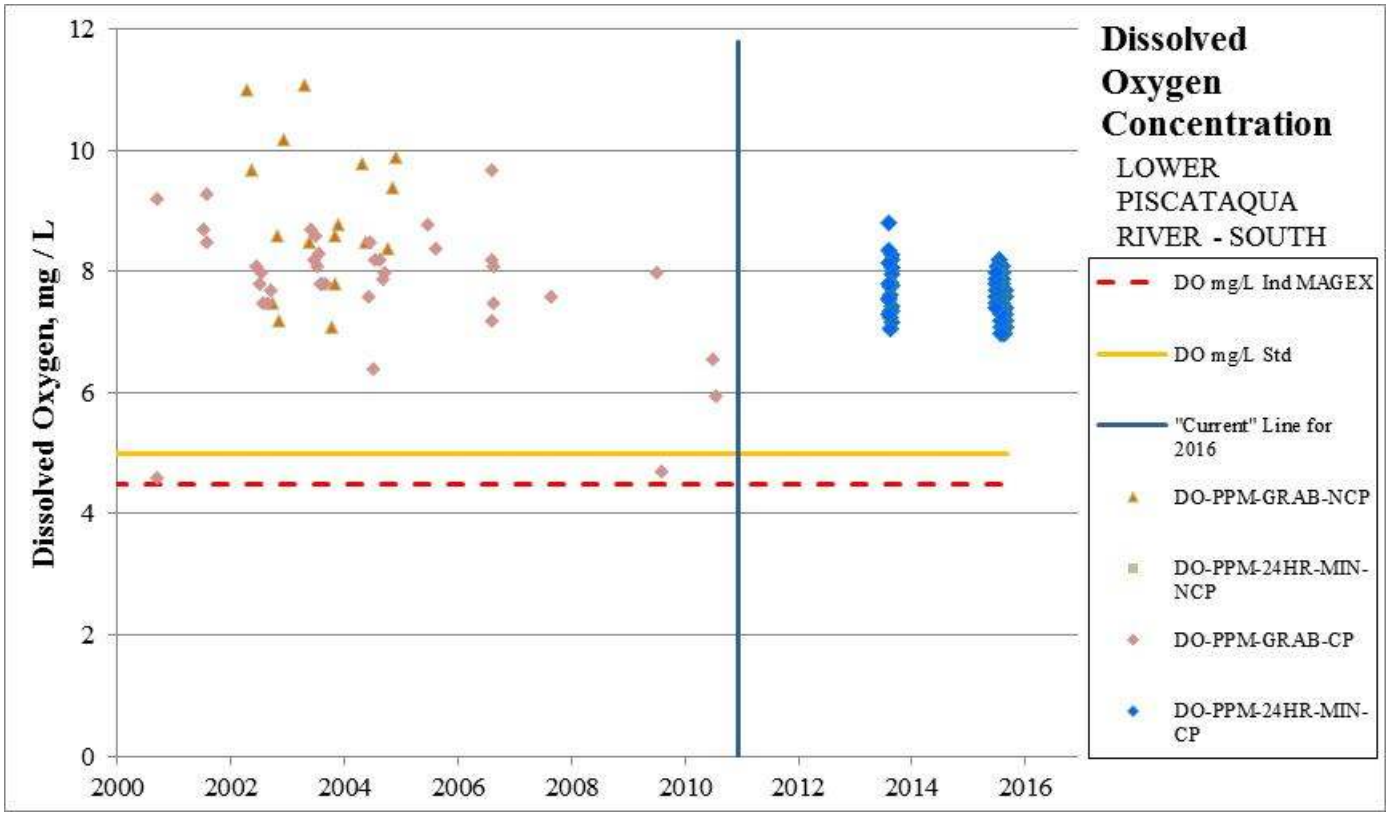
Lower Piscataqua River - North Assessment Zone	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	5	1.2	1.9	-	3.0
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	0	-	-	-	-
CHLOROPHYLL A, combined	5	0.0	1.9	-	3.0
DO-PERC-24H-MEAN-CP	88	89.2	99.8	106.8	114.1
DO-PERC-24H-MEAN-NCP	0	-	-	-	-
DO-PERC-2TIDE-GRAB-CP	0	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP	0	-	-	-	-
DO-PPM-24HR-MIN-CP	90	6.8	7.5	8.0	8.6
DO-PPM-24HR-MIN-NCP	1	7.1	7.1	-	7.1
DO-PPM-GRAB-CP	0	-	-	-	-
DO-PPM-GRAB-NCP	0	-	-	-	-
LIGHT ATTENUATION COEFFICIENT	4	0.520	**0.765**	-	0.950
TURBIDITY	24	2.4	3.6	4.5	5.1
Day Ave of TN	2	236	**292**	-	348
Day Ave of TDN	2	164	200	-	235
Day Ave of DIN (NH3 + NO2/3)	2	8	53	-	97
Day Ave of NH3	2	3	19	-	34
Day Ave of PON	2	72	93	-	113
Day Ave of NO2/3	2	5	34	-	63

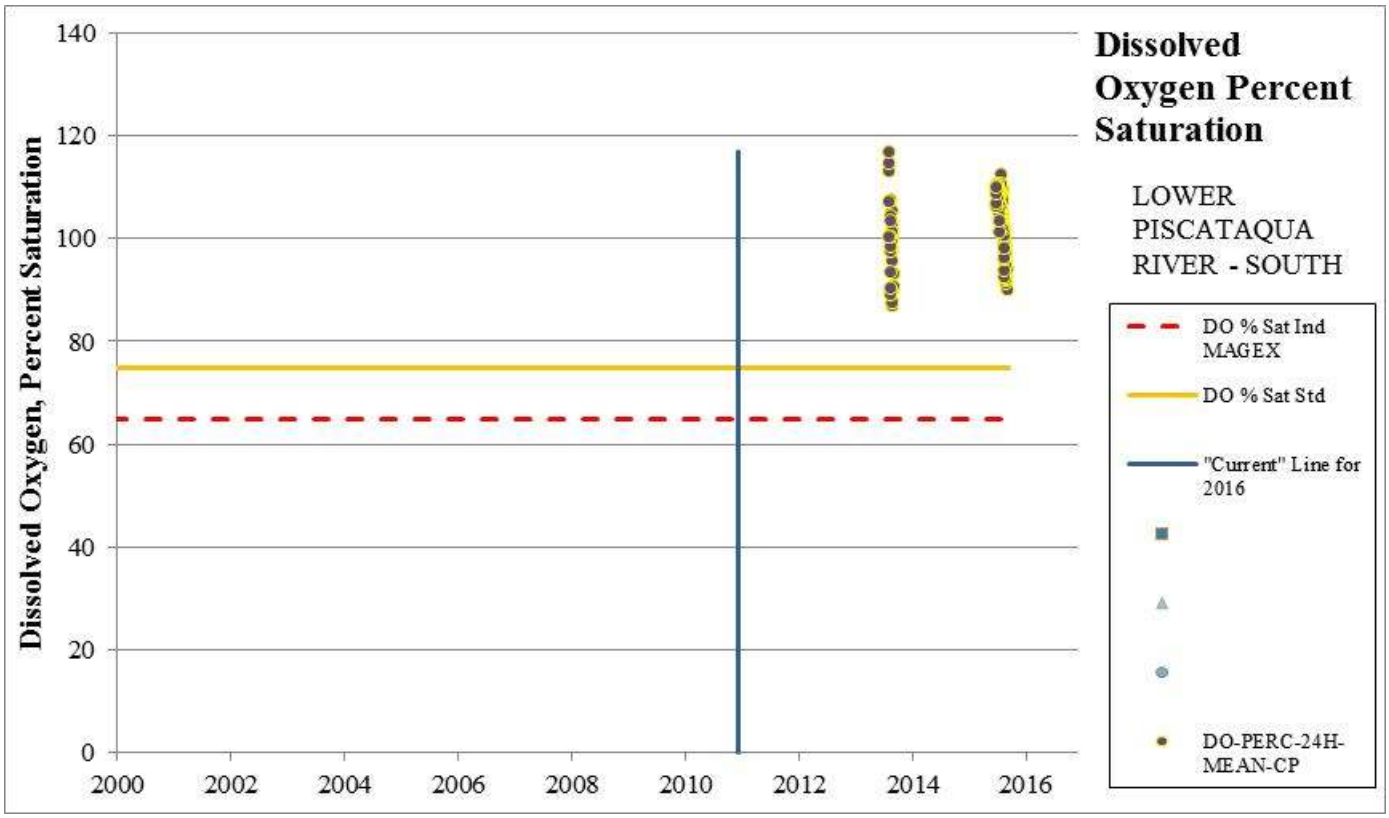
Assessment Zone = LOWER PISCATAQUA RIVER - SOUTH

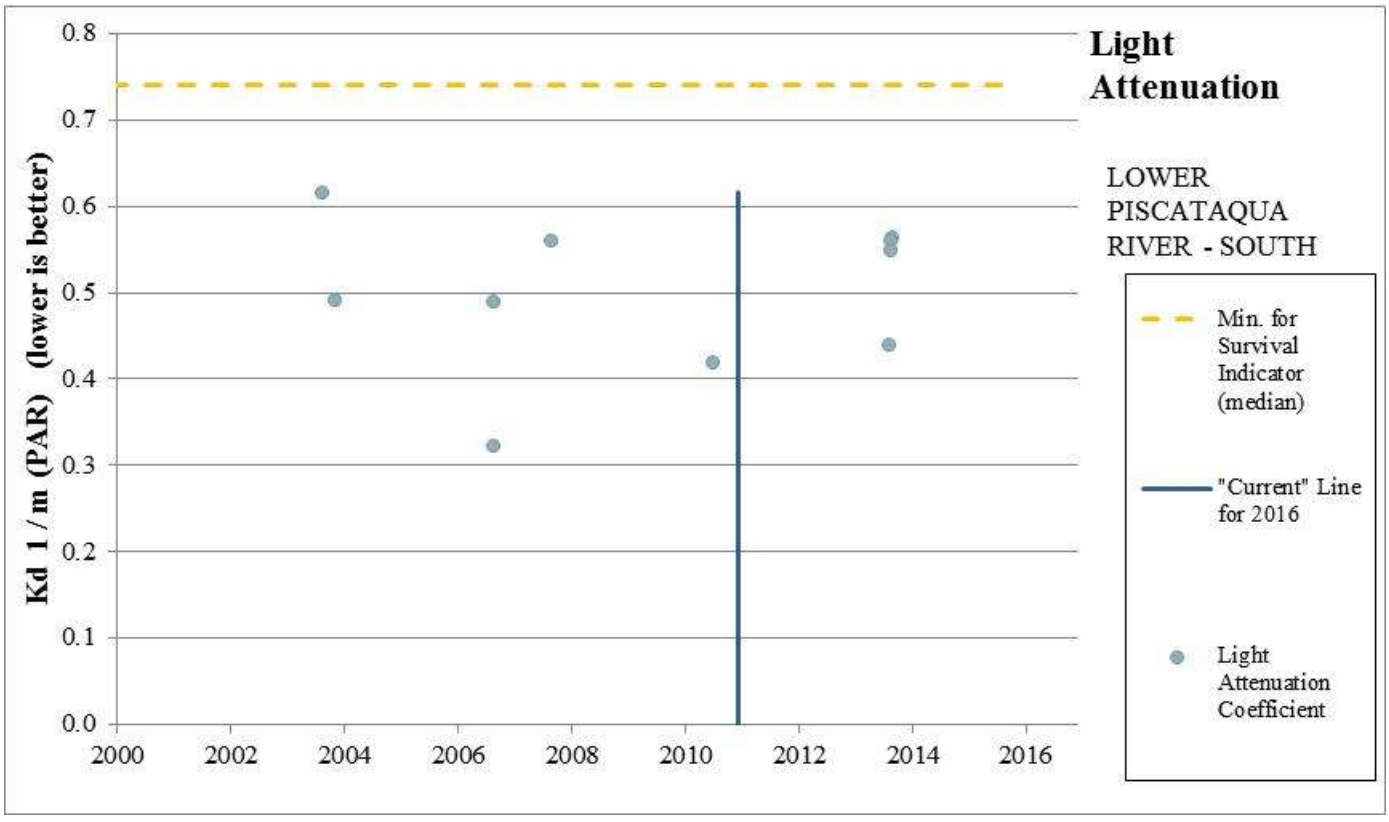
(NHEST600031001-02-02)

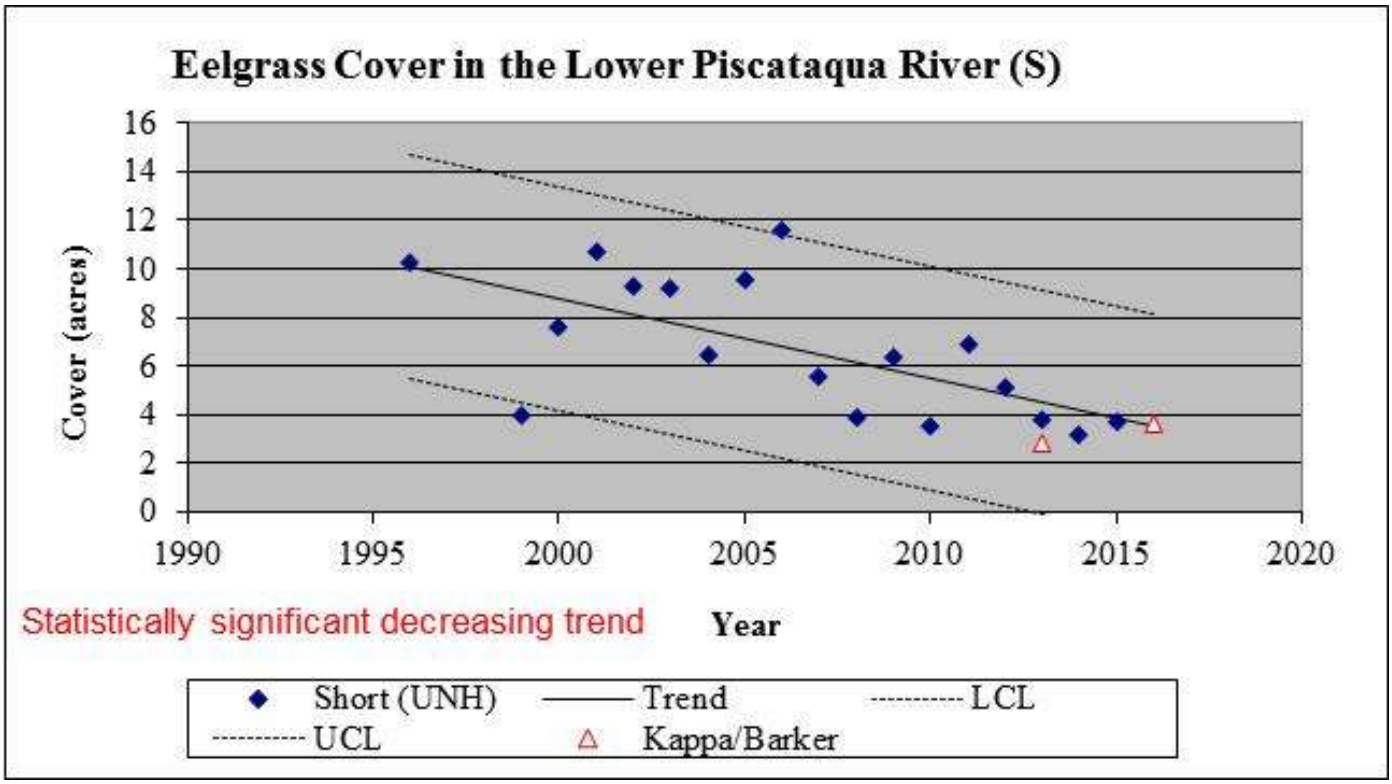
Indicator	Aquatic Life Use Category 2014 / 2016	2016 Comment
Chlorophyll-a	3-PAS / 3-PAS	The calculated 90th percentile chlorophyll-a in this assessment zone cannot be calculated due to the presence of only five measured values since 2011 (1.0 to 3.3 ug/L). The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. The limited available data leads to an assessment of Insufficient Information – Potentially Attaining.
Dissolved Oxygen (mg/L)	2-G / 2-G	This assessment zone had datalogger deployments in 2013 and 2015. During those periods no dissolved oxygen concentration measurements fell below 5 mg/L. The available data indicates that this assessment zone meets the dissolved oxygen concentration criteria.
Dissolved Oxygen (% Saturation)	2-G / 2-G	This assessment zone had datalogger deployments in 2013 and 2015 to compare to the dissolved oxygen percent saturation criteria. During that period no dissolved oxygen 24 hour average percent saturation measurement fell below 75 percent. The available data indicates that this assessment zone meets the dissolved oxygen percent saturation criteria.
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 32.5 acres from the 1948, 1962, 1980, and 1981 datasets. The median current extent of eelgrass in 2014-2016 is 3.6 acres, which is a decrease of 88.9%. Since 1990, the trend in eelgrass cover in this assessment zone is a loss of 29.5%. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	3-PAS / 3-PAS	Median=0.565 m^-1 (n=4). For an eelgrass restoration depth of 2 m, the light attenuation coefficient threshold is 0.75 m^-1. This assessment zone historically had eelgrass growing in both the shallows and deeper habitat making the 2m restoration depth a valid target. Therefore, the insufficient information – potentially attaining standards (3-PAS) assessment from the 2014 305(b) assessment has been retained.
Total Nitrogen	3-PNS / 3-PAS	The median total nitrogen from 2011 through 2015 was 229 ug/L (n=2). There are no documented dissolved oxygen concentration or saturation criteria exceedences in the available data. The limited chlorophyll-a data suggests that this assessment zone would meet chlorophyll-a indicator to protect dissolved oxygen. The eelgrass beds are severely degraded however the limited available light attenuation (median=0.565 m^-1 (n=4)) appears sufficient for the 2 m restoration depth. There data to indicate that the eutrophication signal is low in this assessment zone but there is little total nitrogen data. As such, the assessment zone has been assessed as insufficient information-potential attaining standards for total nitrogen

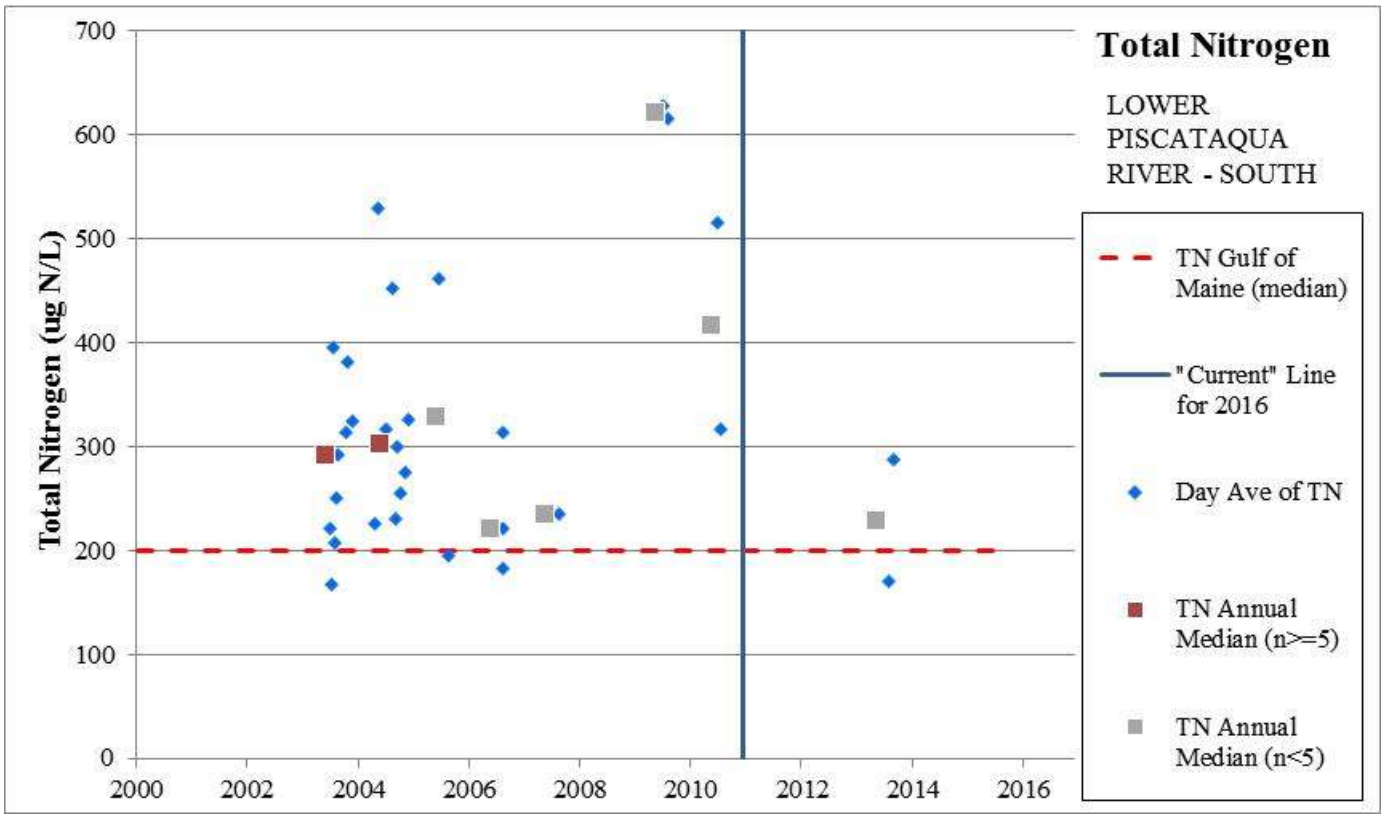

Chlorophyll-a
LOWER PISCATAQUA RIVER - SOUTH
ug Chl-a / L
Chl-a Ind. (90th percentile)
"Current" Line for 2016
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN


Dissolved Oxygen Concentration
LOWER PISCATAQUA RIVER - SOUTH
Dissolved Oxygen, mg / L
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2016
DO-PPM-GRAB-NCP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-24HR-MIN-CP


Dissolved Oxygen Percent Saturation
LOWER PISCATAQUA RIVER - SOUTH
Dissolved Oxygen, Percent Saturation
140
120
100
80
60
40
20
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2016
DO-PERC-24H-MEAN-CP


Light Attenuation
LOWER PISCATAQUA RIVER - SOUTH
Kd 1 / m (PAR) (lower is better)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
Min. for Survival Indicator (median)
"Current" Line for 2016
Light Attenuation Coefficient


Eelgrass Cover in the Lower Piscataqua River (S)
Cover (acres)
16
14
12
10
8
6
4
2
0
1990
1995
2000
2005
2010
2015
2020
Year
Statistically significant decreasing trend
Short (UNH)
Trend
LCL
UCL
Kappa/Barker

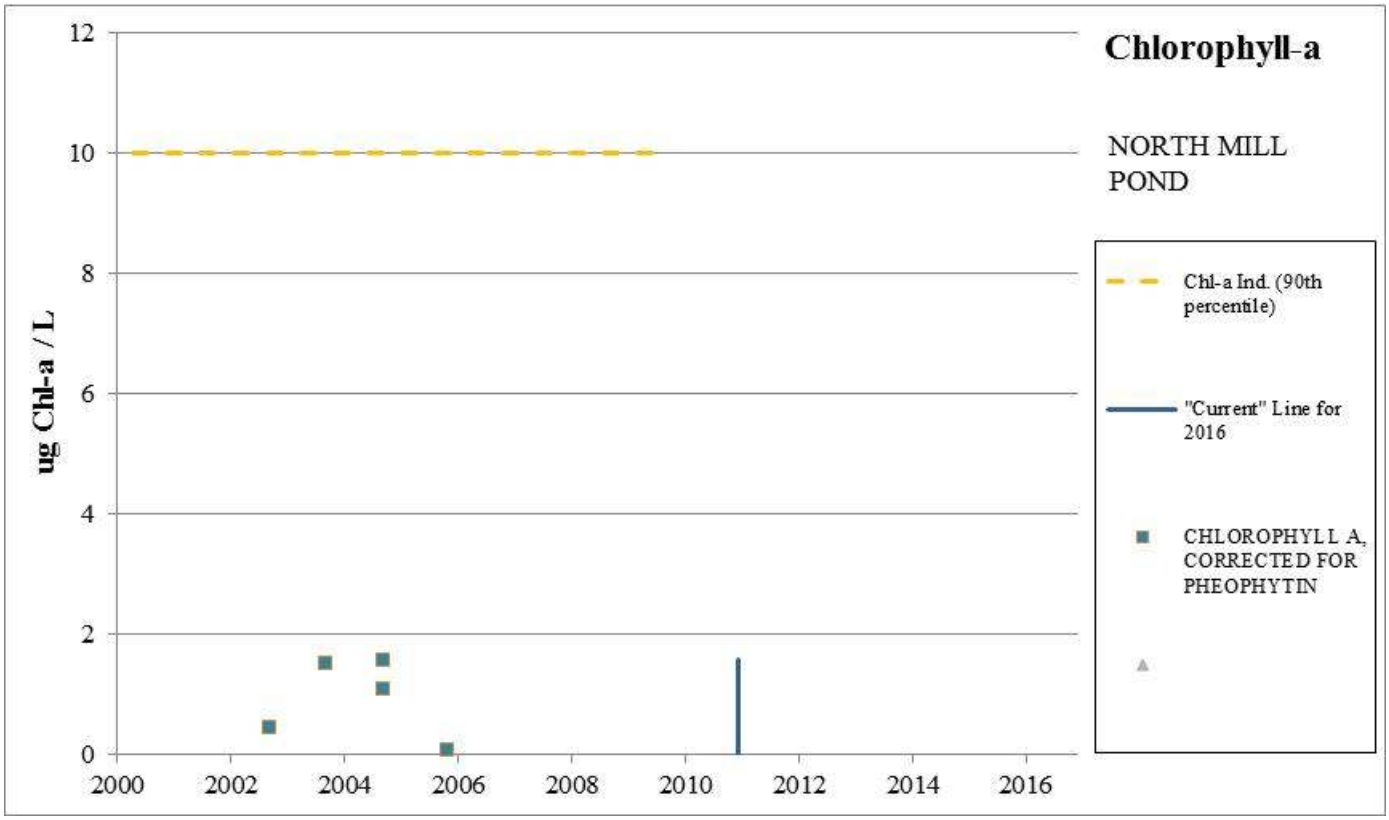

Total Nitrogen
LOWER PISCATAQUA RIVER - SOUTH
Total Nitrogen (ug N/L)
700
600
500
400
300
200
100
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
TN Gulf of Maine (median)
"Current" Line for 2016
Day Ave of TN
TN Annual Median (n>=5)
TN Annual Median (n<5)

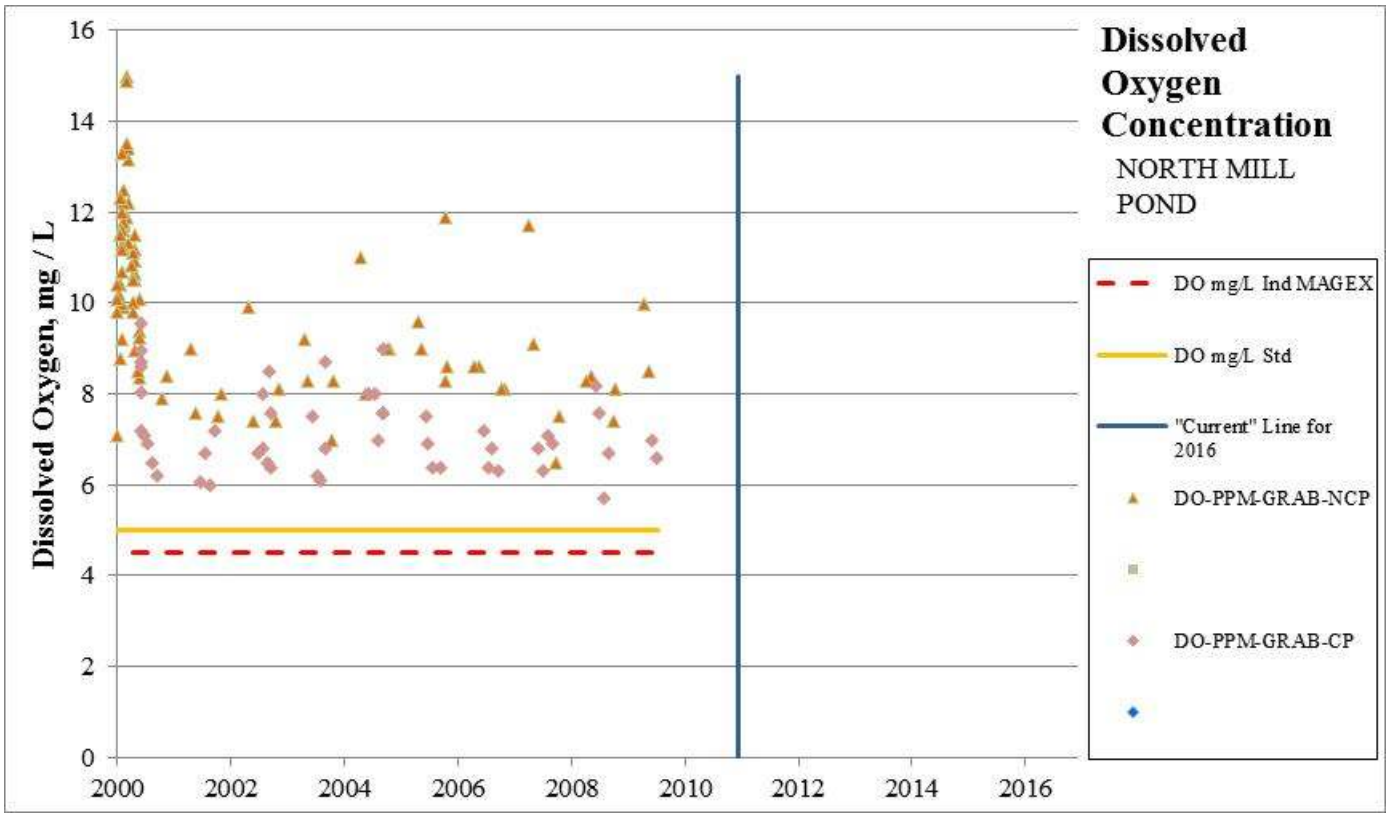
Lower Piscataqua River - South Assessment Zone	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	5	1.0	1.6	-	3.3
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	0	-	-	-	-
CHLOROPHYLL A, combined	5	0.0	1.6	-	3.3
DO-PERC-24H-MEAN-CP	95	87.1	103.8	110.2	116.9
DO-PERC-24H-MEAN-NCP	0	-	-	-	-
DO-PERC-2TIDE-GRAB-CP	0	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP	0	-	-	-	-
DO-PPM-24HR-MIN-CP	96	7.0	7.6	8.1	8.8
DO-PPM-24HR-MIN-NCP	1	7.1	7.1	-	7.1
DO-PPM-GRAB-CP	0	-	-	-	-
DO-PPM-GRAB-NCP	0	-	-	-	-
LIGHT ATTENUATION COEFFICIENT	4	0.450	**0.565**	-	0.575
TURBIDITY	25	1.0	1.4	2.3	7.5
Day Ave of TN	2	170	**229**	-	288
Day Ave of TDN	2	140	168	-	196
Day Ave of DIN (NH3 + NO2/3)	2	10	48	-	86
Day Ave of NH3	2	8	18	-	27
Day Ave of PON	2	30	61	-	92
Day Ave of NO2/3	2	2	31	-	59

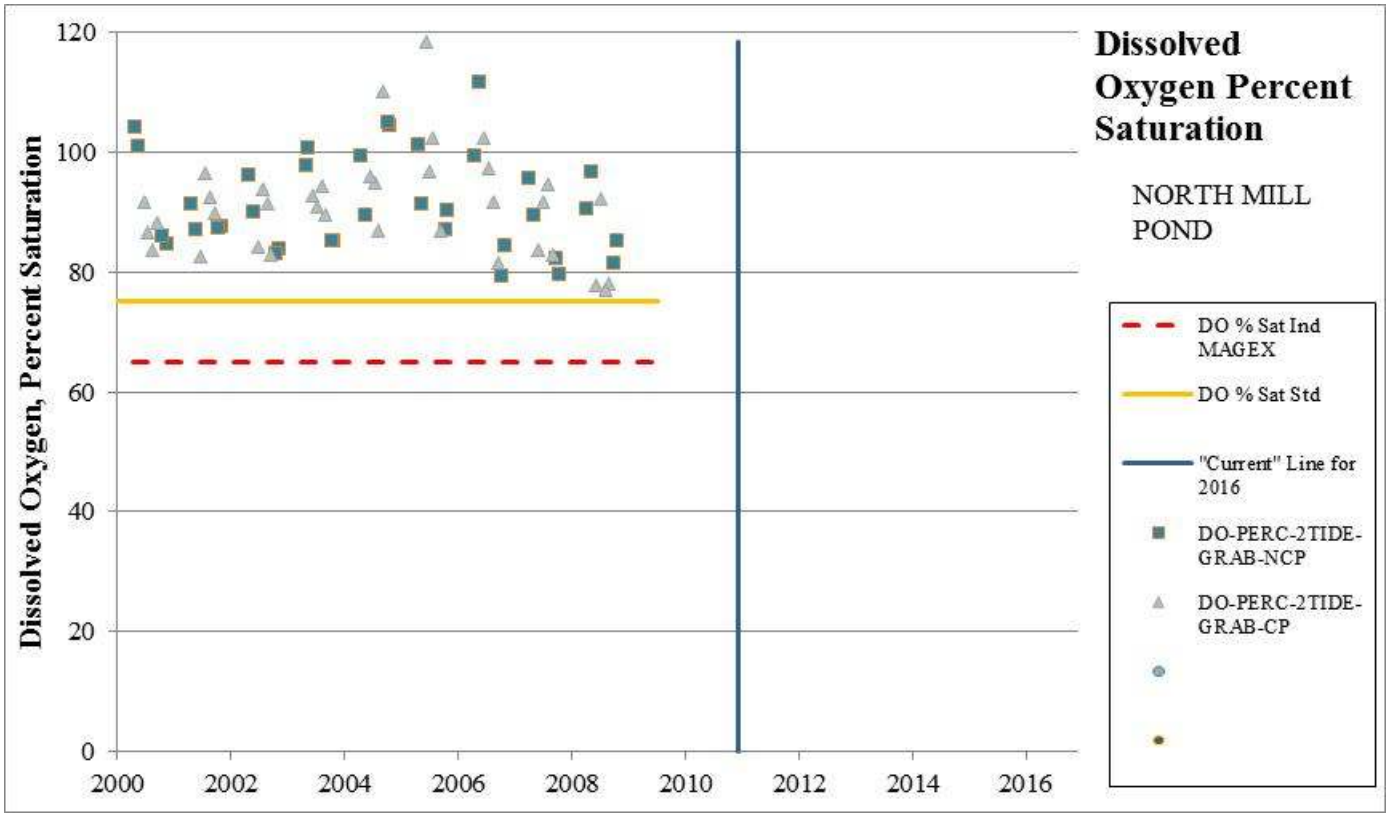
Assessment Zone = NORTH MILL POND

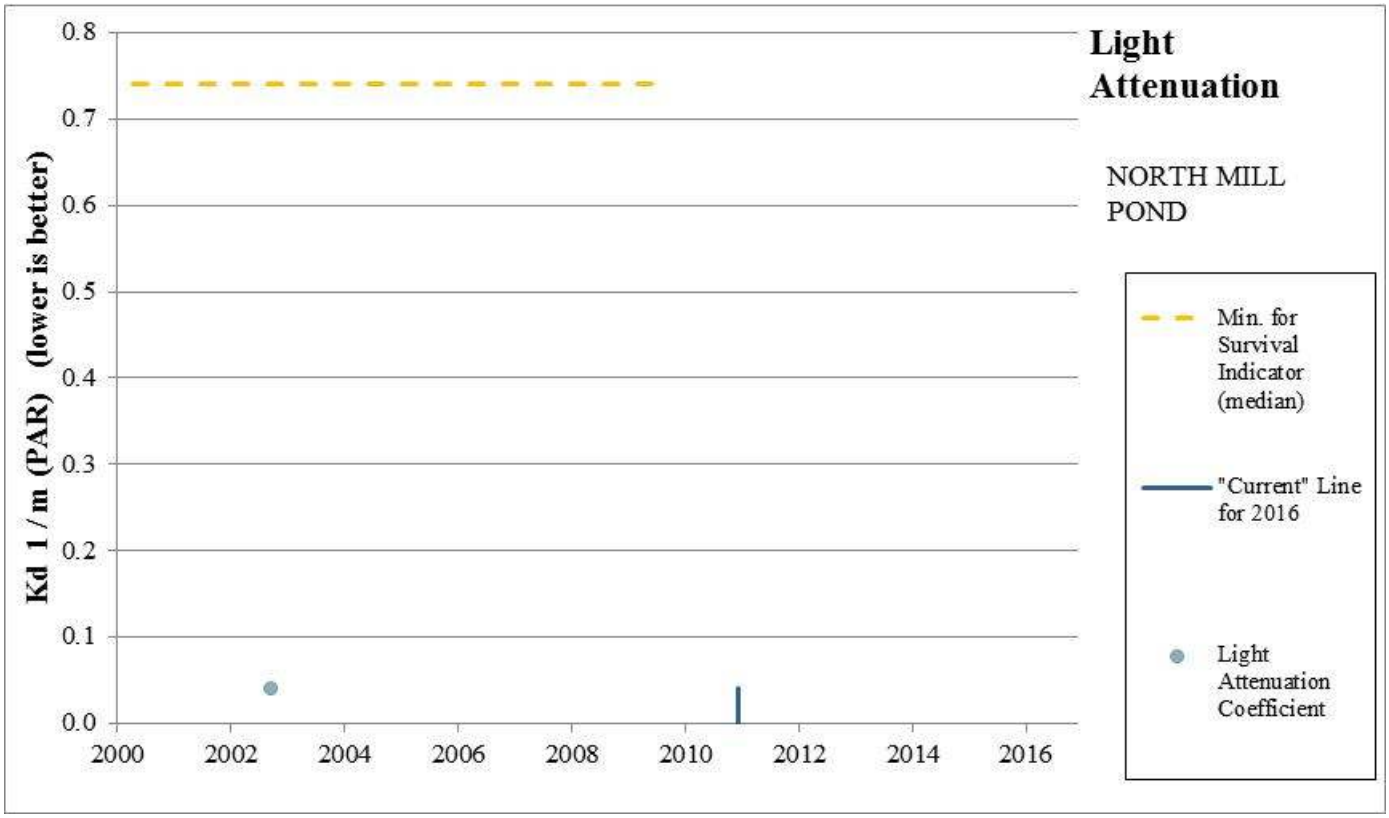
(NHEST600031001-10)

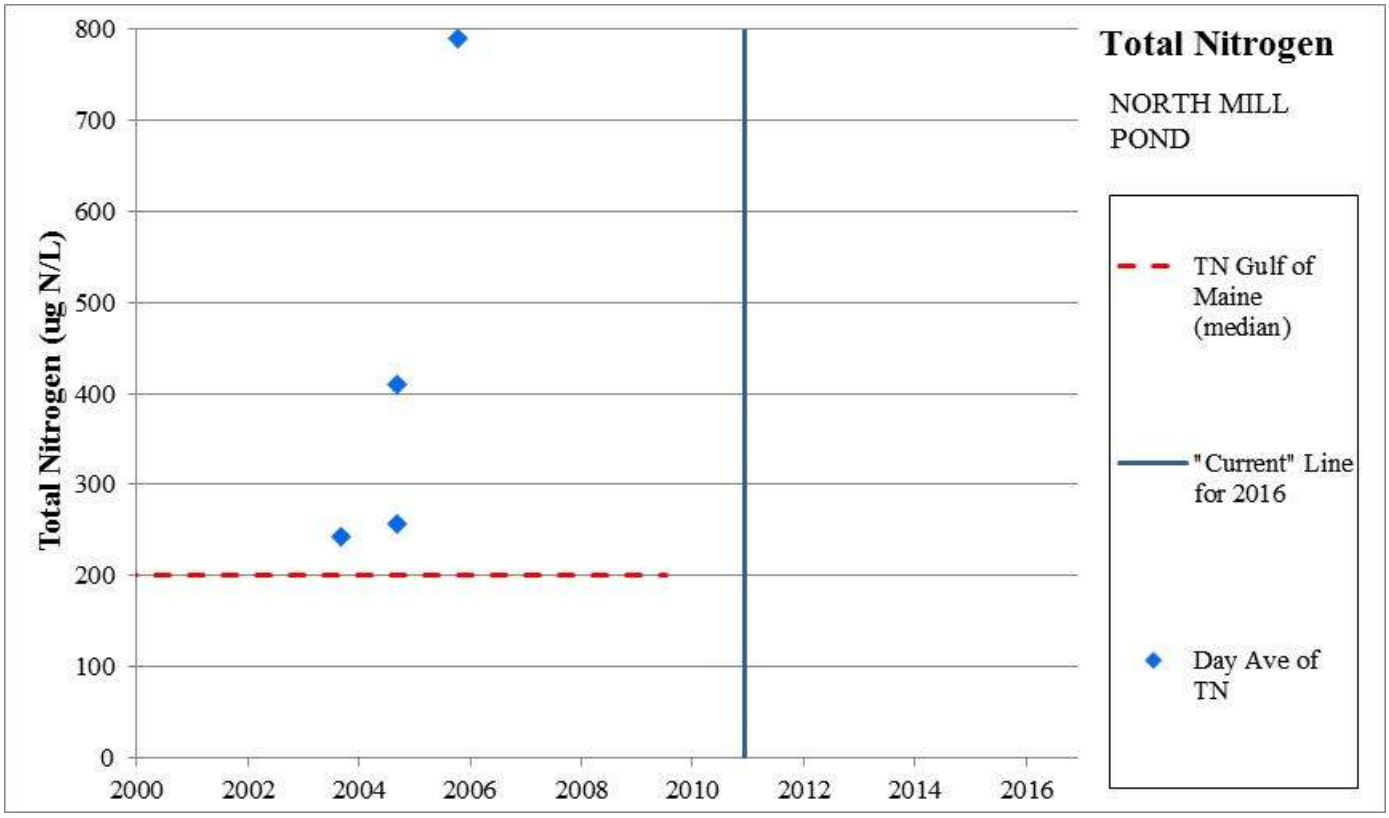
Indicator	Aquatic Life Use Category 2014 / 2016	2016 Comment
Chlorophyll-a	3-ND / 3-ND	The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. This assessment zone has no measurements for chlorophyll-a since 2005.
Dissolved Oxygen (mg/L)	2-G / 3-ND	This assessment zone has only grab sample measurements for dissolved oxygen concentration and those measurements were only collected up through 2009. As such, this assessment zone has been assessed as 3-ND (No Data) dissolved oxygen concentration.
Dissolved Oxygen (% Saturation)	2-G / 3-ND	This assessment zone has only grab sample measurements for dissolved oxygen 24 hour average percent saturation and those measurements were only collected up through 2008. As such, this assessment zone has been assessed as 3-ND (No Data) dissolved oxygen concentration.
Estuarine Bioassessments (eelgrass)	3-ND / 3-ND	No data.
Water Clarity (Light Attenuation Coefficient)	3-ND / 3-ND	No data.
Total Nitrogen	3-ND / 3-ND	No data.




Dissolved Oxygen Concentration
NORTH MILL POND
Dissolved Oxygen, mg / L
0
2
4
6
8
10
12
14
16
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2016
DO-PPM-GRAB-NCP
DO-PPM-GRAB-CP


Dissolved Oxygen Percent Saturation
NORTH MILL POND
Dissolved Oxygen, Percent Saturation
0
20
40
60
80
100
120
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2016
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP


Light Attenuation
NORTH MILL POND
Kd 1 / m (PAR) (lower is better)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
Min. for Survival Indicator (median)
"Current" Line for 2016
Light Attenuation Coefficient

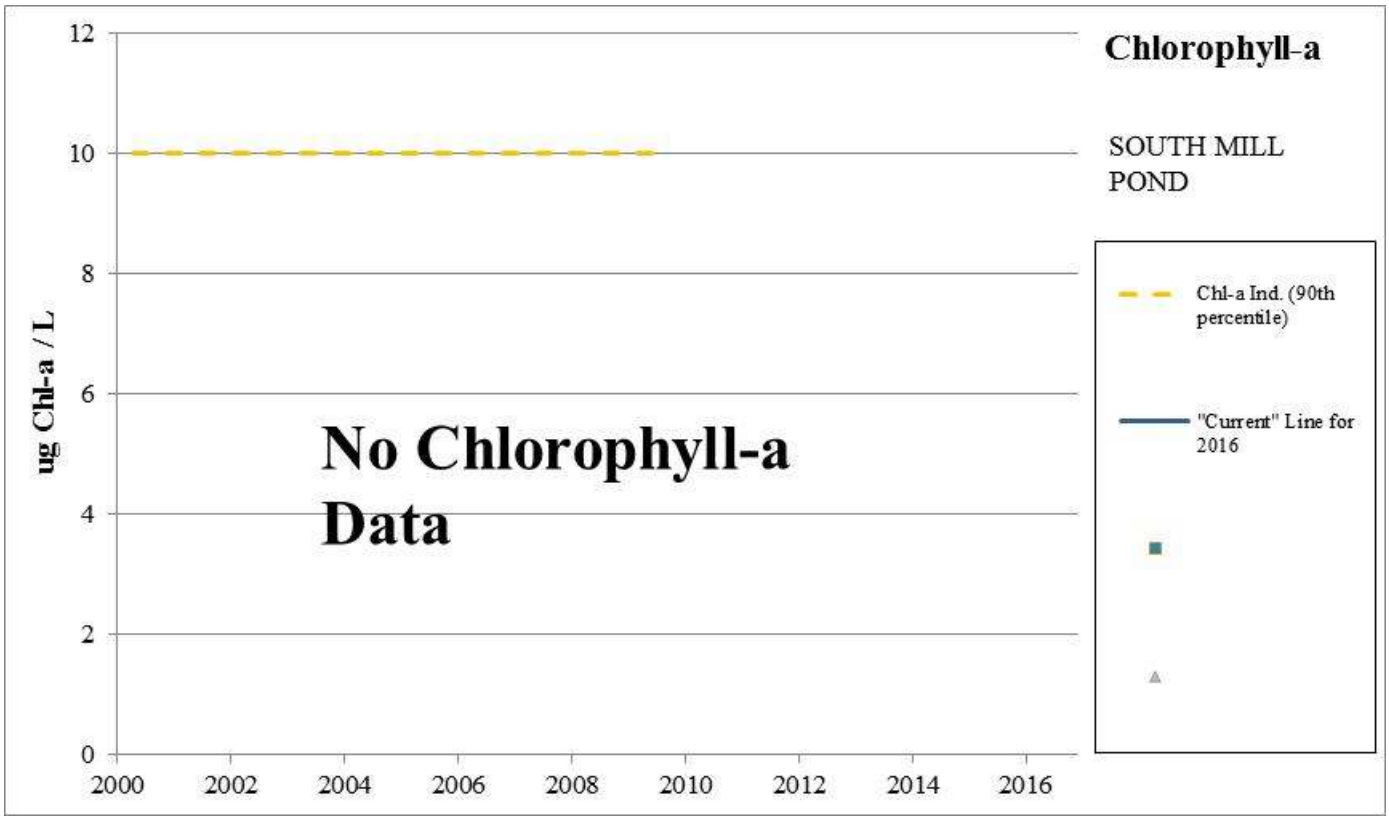

Total Nitrogen
NORTH MILL POND
Total Nitrogen (ug N/L)
800
700
600
500
400
300
200
100
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
TN Gulf of Maine (median)
"Current" Line for 2016
Day Ave of TN

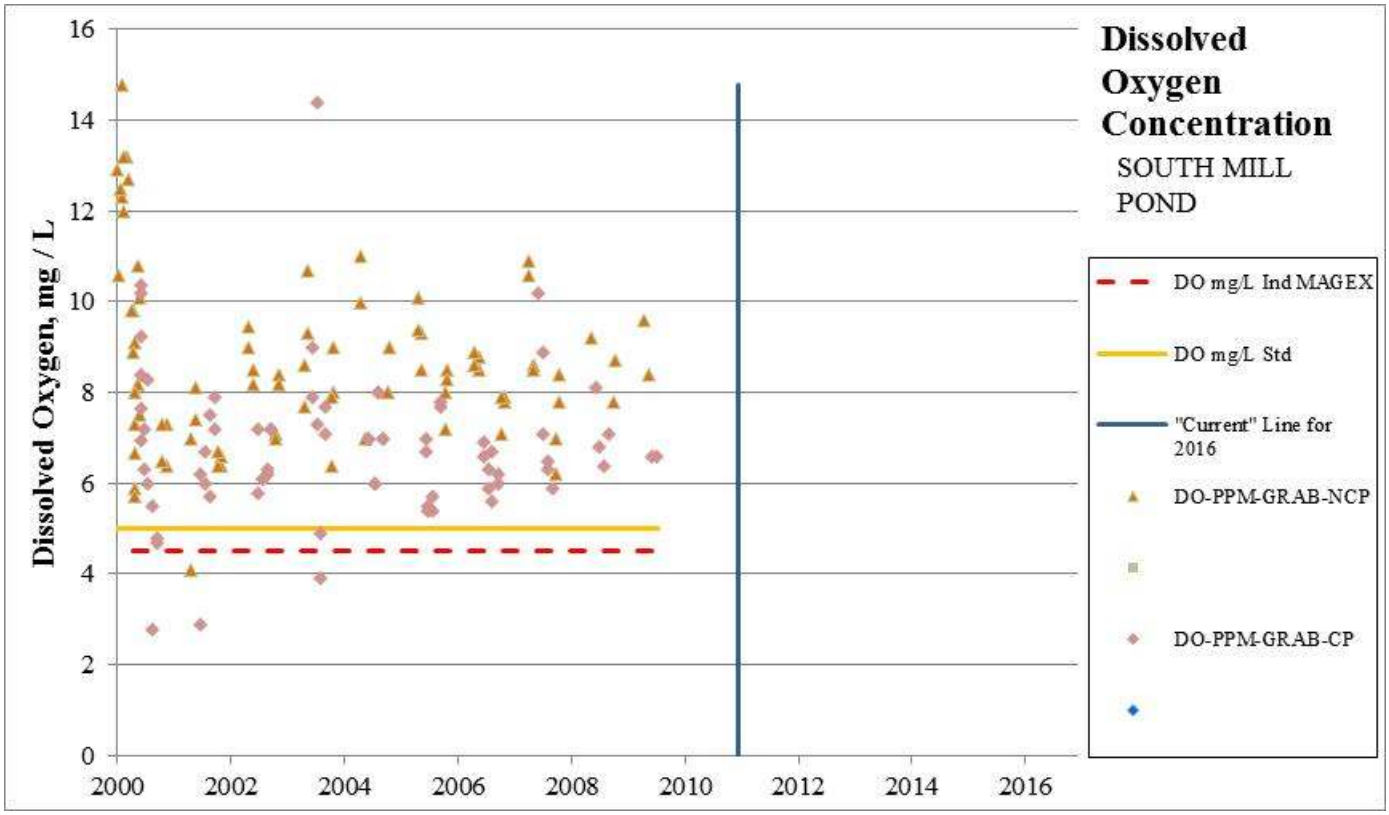
North Mill Pond Assessment Zone	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	0	-	-	-	-
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	0	-	-	-	-
CHLOROPHYLL A, combined	0	-	-	-	-
DO-PERC-24H-MEAN-CP	0	-	-	-	-
DO-PERC-24H-MEAN-NCP	0	-	-	-	-
DO-PERC-2TIDE-GRAB-CP	0	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP	0	-	-	-	-
DO-PPM-24HR-MIN-CP	0	-	-	-	-
DO-PPM-24HR-MIN-NCP	0	-	-	-	-
DO-PPM-GRAB-CP	0	-	-	-	-
DO-PPM-GRAB-NCP	0	-	-	-	-
LIGHT ATTENUATION COEFFICIENT	0	-	-	-	-
TURBIDITY	0	-	-	-	-
Day Ave of TN	0	-	-	-	-
Day Ave of TDN	0	-	-	-	-
Day Ave of DIN (NH3 + NO2/3)	0	-	-	-	-
Day Ave of NH3	0	-	-	-	-
Day Ave of PON	0	-	-	-	-
Day Ave of NO2/3	0	-	-	-	-

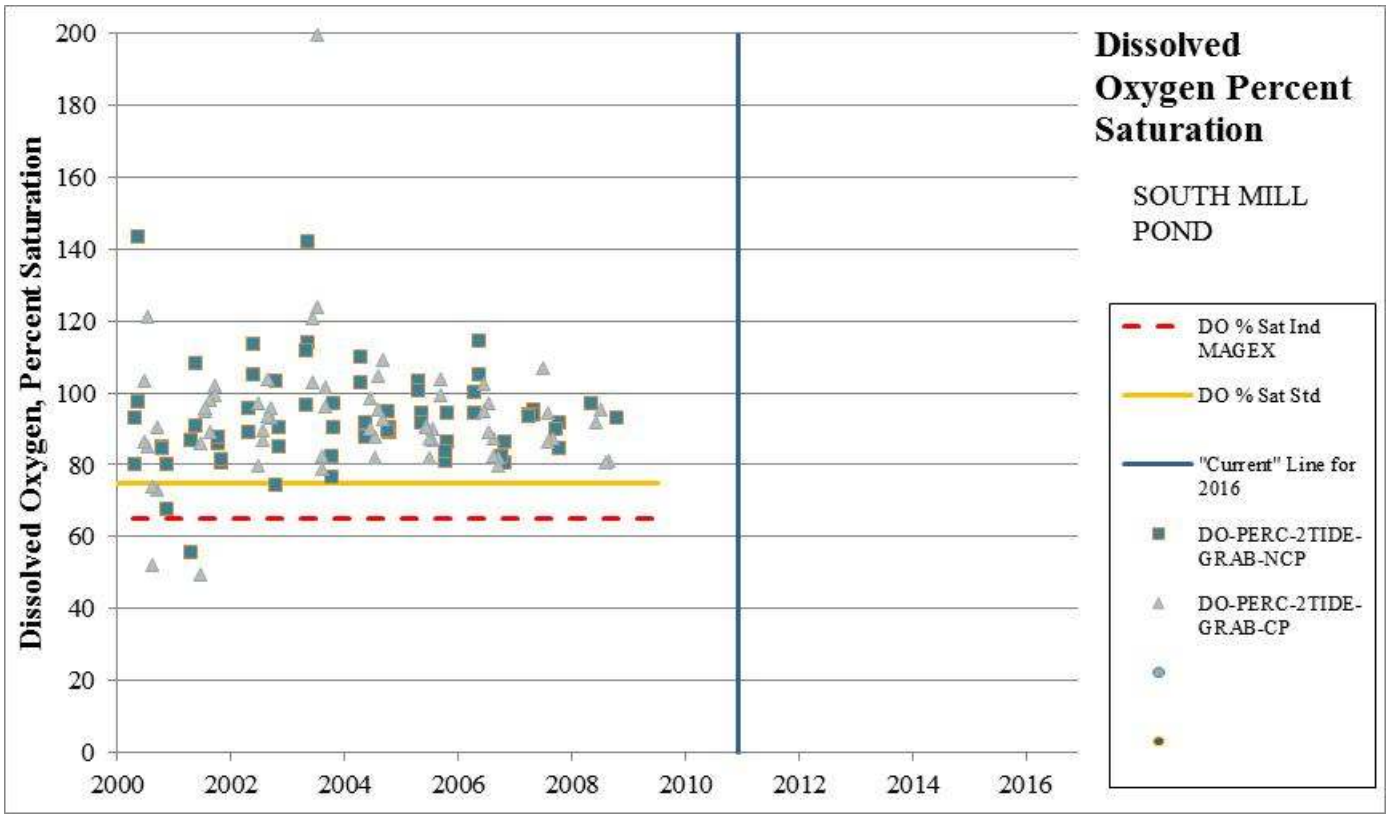
Assessment Zone = SOUTH MILL POND

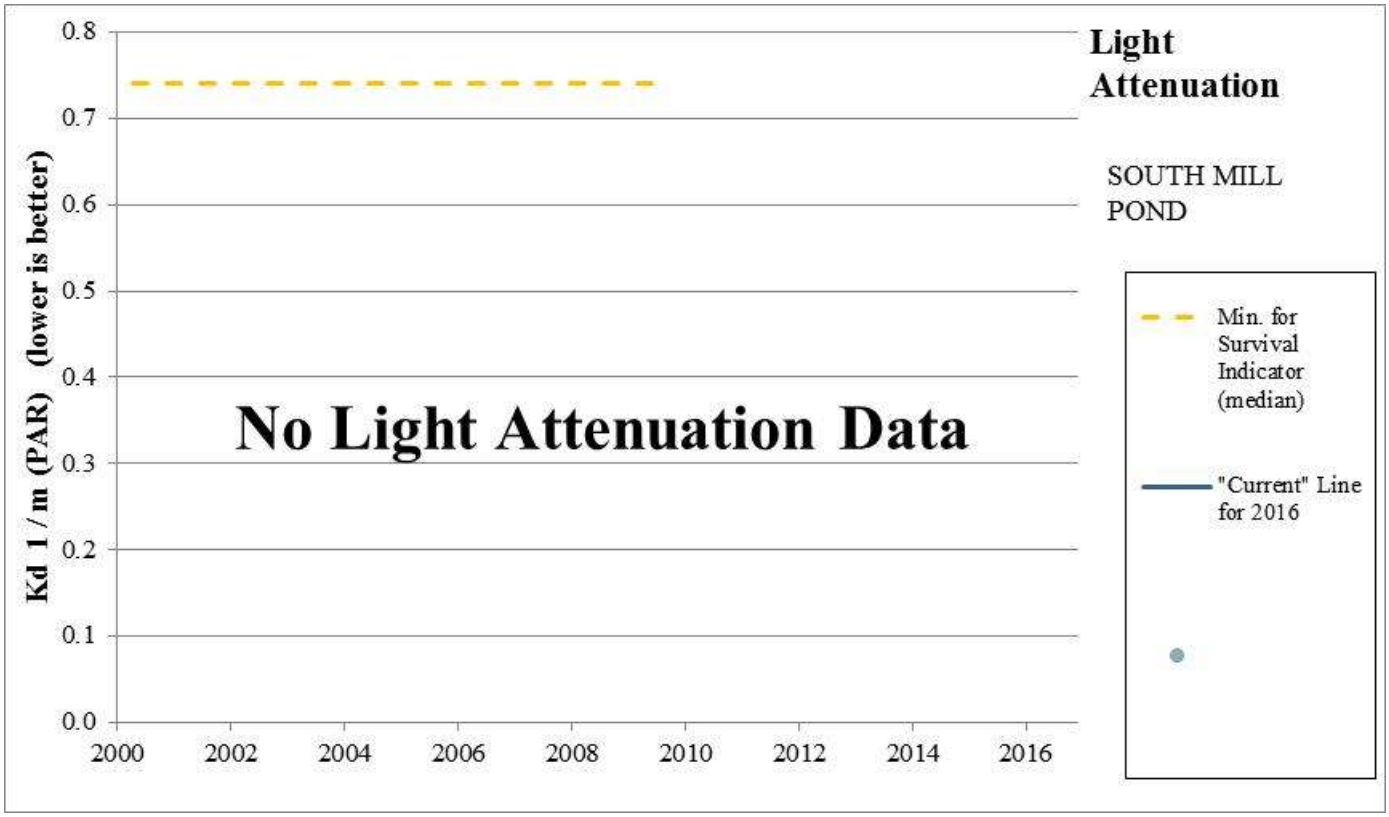
(NHEST600031001-09)

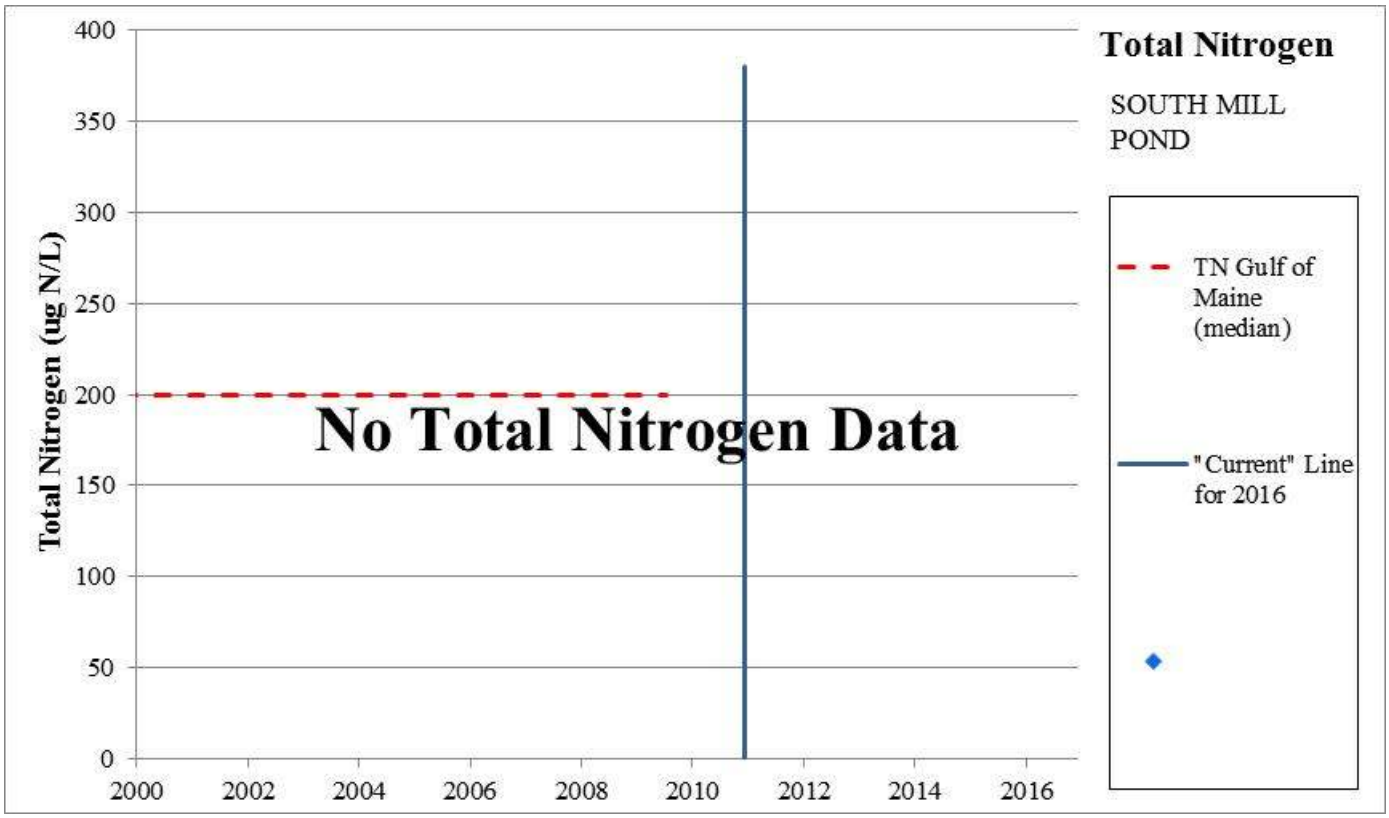
Indicator	Aquatic Life Use Category 2014 / 2016	2016 Comment
Chlorophyll-a	3-ND / 3-ND	The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. However, there is no chlorophyll-a data for this assessment zone.
Dissolved Oxygen (mg/L)	2-G / 3-ND	This assessment zone has only grab sample measurements for dissolved oxygen concentration and those measurements were only collected up through 2009. As such, this assessment zone has been assessed as 3-ND (No Data) dissolved oxygen concentration.
Dissolved Oxygen (% Saturation)	2-G / 3-ND	This assessment zone has only grab sample measurements for dissolved oxygen 24 hour average percent saturation and those measurements were only collected up through 2008. As such, this assessment zone has been assessed as 3-ND (No Data) dissolved oxygen concentration.
Estuarine Bioassessments (eelgrass)	3-ND / 3-PAS	A 0.012 acres (520 sq feet) patch of eelgrass was seen in South Mill Pond for the first time. While the patch was below the minimum mapping unit and not field verified, the mapper was confident that based on morphology and growth pattern the plant seen was indeed *Zostera marina*. As there is no known baseline for comparison and the mapping effort only represents a single year of presence, estuarine bioassessments (eelgrass) has been assessed as Insufficient Information – Potentially Attaining Standards.
Water Clarity (Light Attenuation Coefficient)	3-ND / 3-ND	No data.
Total Nitrogen	3-ND / 3-ND	No data.


Chlorophyll-a
SOUTH MILL POND
ug Chl-a / L
No Chlorophyll-a Data
Chl-a Ind. (90th percentile)
"Current" Line for 2016
0
2
4
6
8
10
12
2000
2002
2004
2006
2008
2010
2012
2014
2016


Dissolved Oxygen Concentration
SOUTH MILL POND
Dissolved Oxygen, mg / L
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2016
DO-PPM-GRAB-NCP
DO-PPM-GRAB-CP
0
2
4
6
8
10
12
14
16
2000
2002
2004
2006
2008
2010
2012
2014
2016


Dissolved Oxygen Percent Saturation
SOUTH MILL POND
Dissolved Oxygen, Percent Saturation
200
180
160
140
120
100
80
60
40
20
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2016
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP


Light Attenuation
SOUTH MILL POND
Kd 1 / m (PAR) (lower is better)
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
No Light Attenuation Data
Min. for Survival Indicator (median)
"Current" Line for 2016

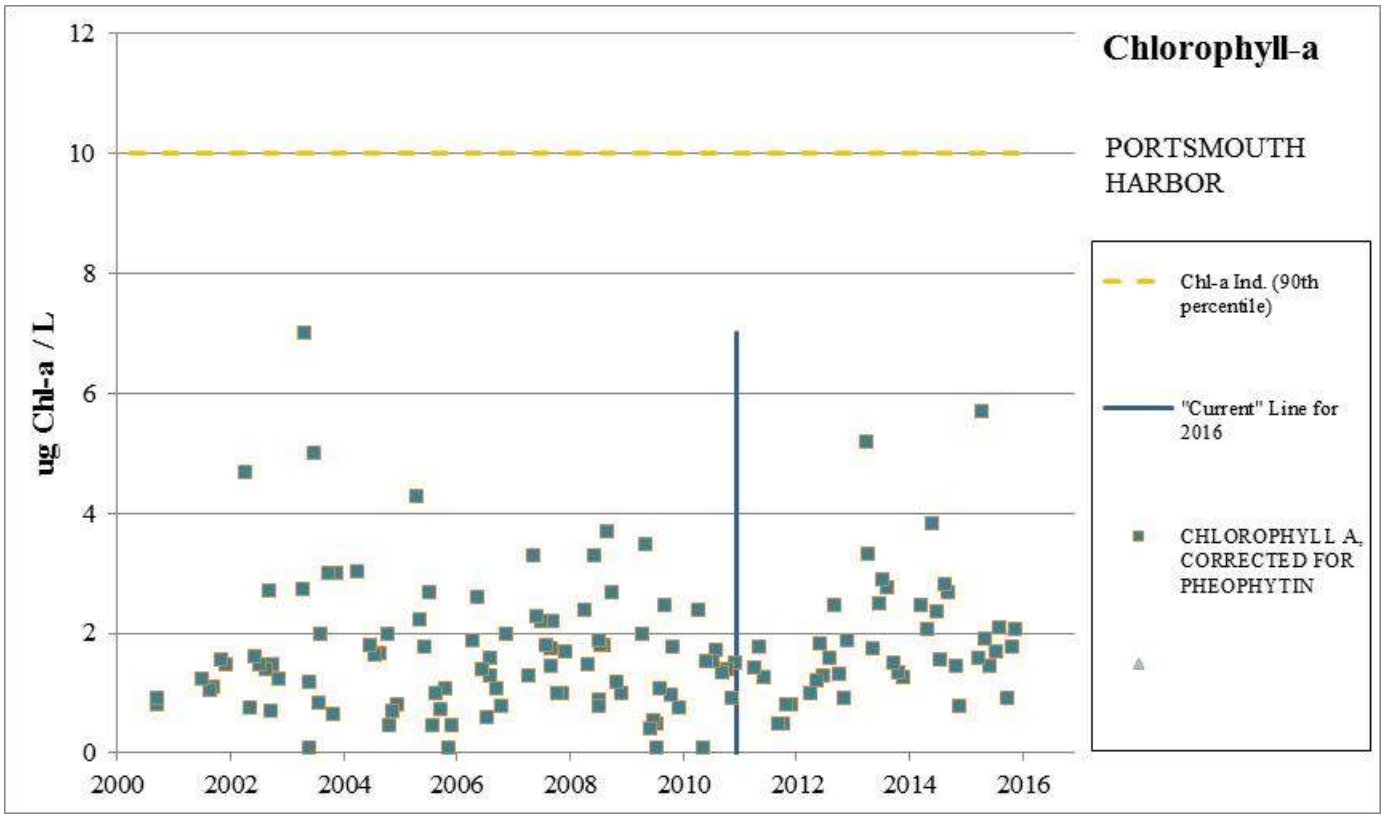


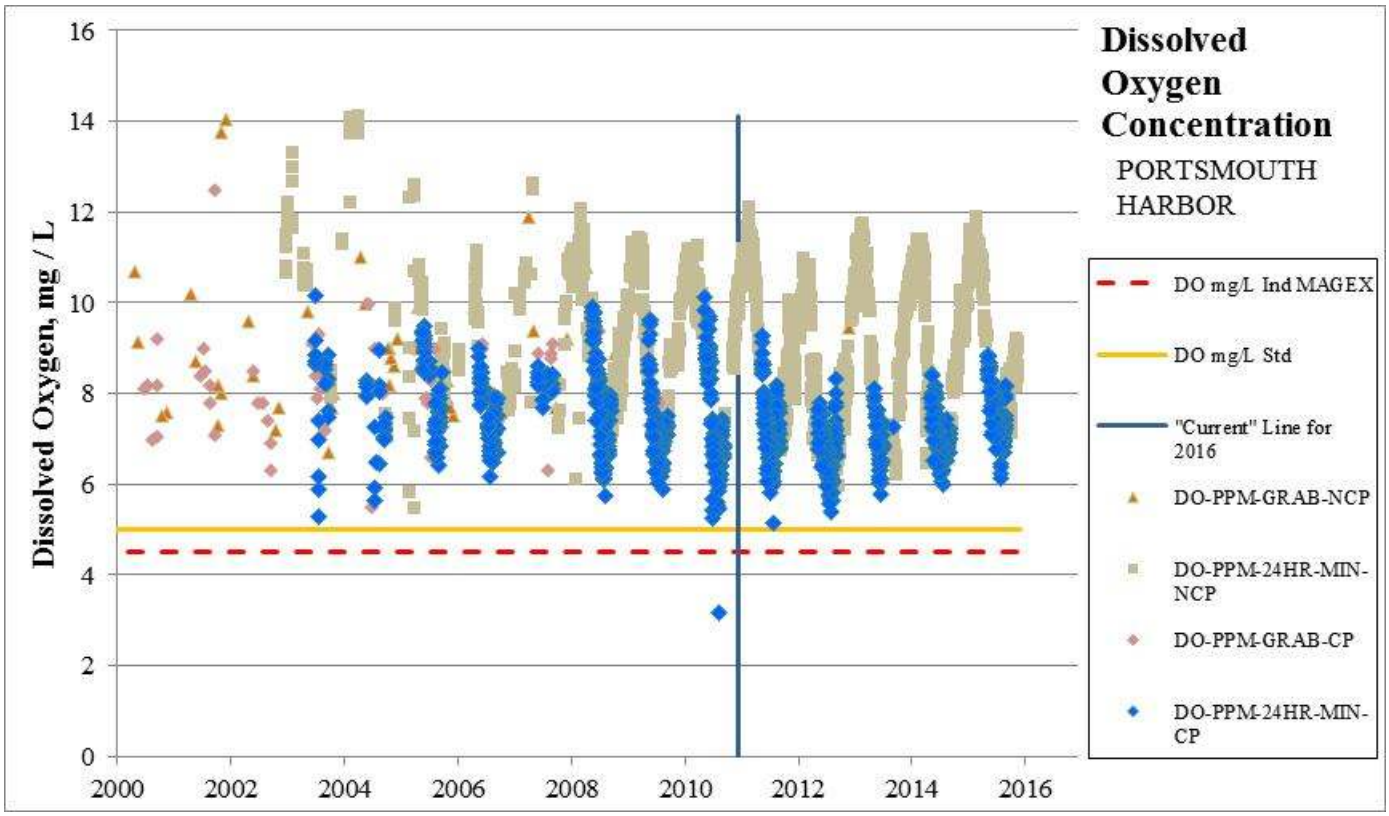
South Mill Pond Assessment Zone	Count	Minimum	Median	90th Percentile	Maximum
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	0	-	-	-	-
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	0	-	-	-	-
CHLOROPHYLL A, combined	0	-	-	-	-
DO-PERC-24H-MEAN-CP	0	-	-	-	-
DO-PERC-24H-MEAN-NCP	0	-	-	-	-
DO-PERC-2TIDE-GRAB-CP	0	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP	0	-	-	-	-
DO-PPM-24HR-MIN-CP	0	-	-	-	-
DO-PPM-24HR-MIN-NCP	0	-	-	-	-
DO-PPM-GRAB-CP	0	-	-	-	-
DO-PPM-GRAB-NCP	0	-	-	-	-
LIGHT ATTENUATION COEFFICIENT	0	-	-	-	-
TURBIDITY	0	-	-	-	-
Day Ave of TN	0	-	-	-	-
Day Ave of TDN	0	-	-	-	-
Day Ave of DIN (NH3 + NO2/3)	0	-	-	-	-
Day Ave of NH3	0	-	-	-	-
Day Ave of PON	0	-	-	-	-
Day Ave of NO2/3	0	-	-	-	-

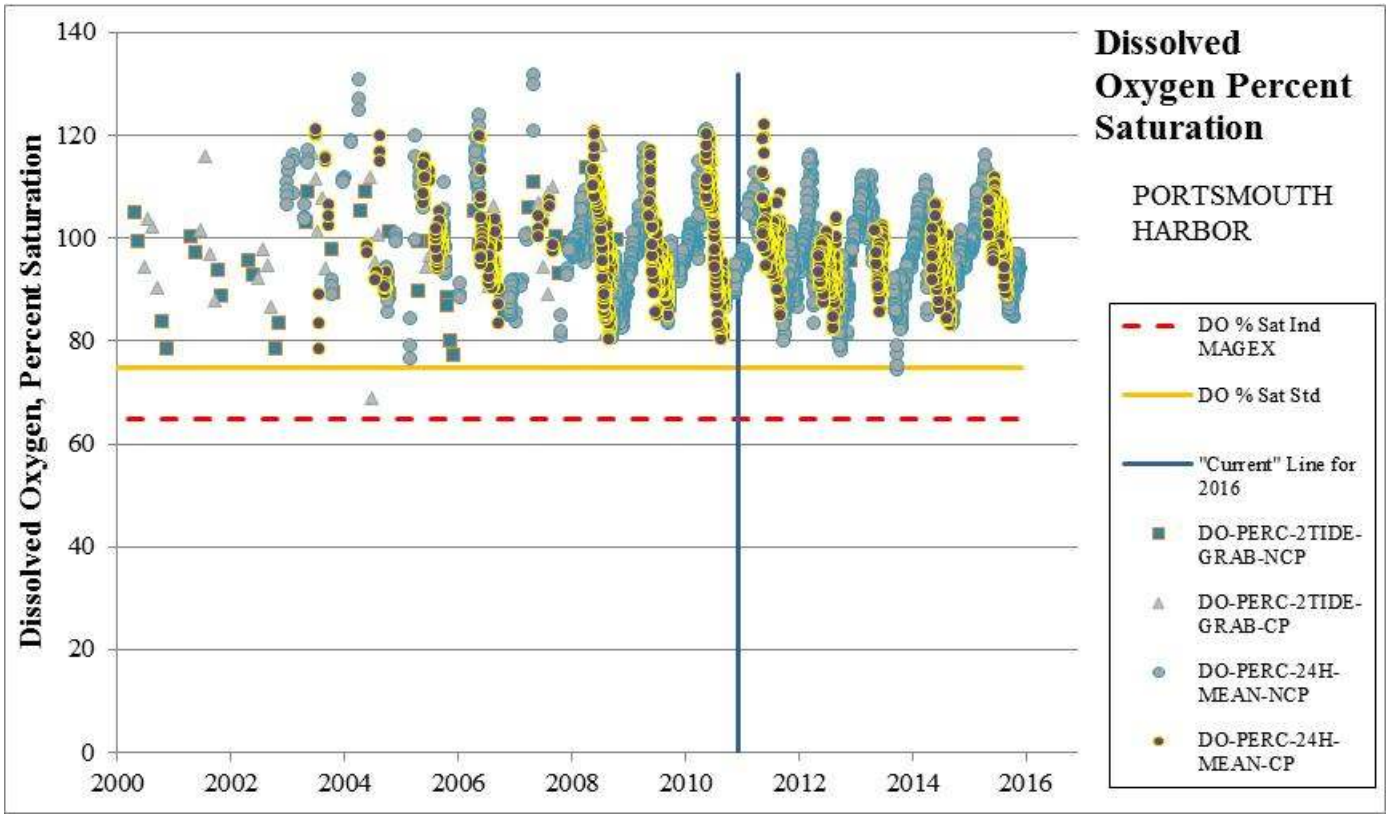
Assessment Zone = PORTSMOUTH HARBOR

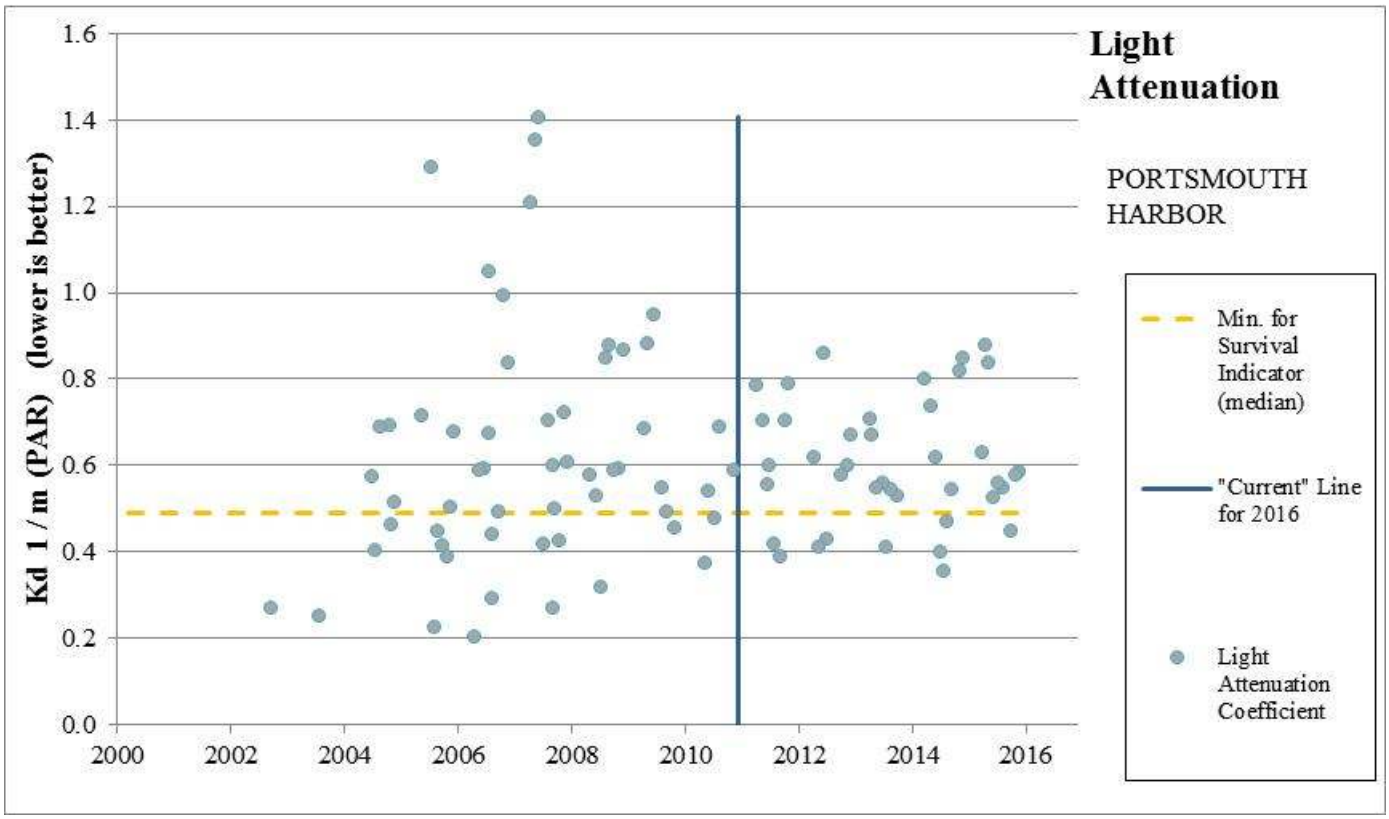
(NHEST600031001-11)

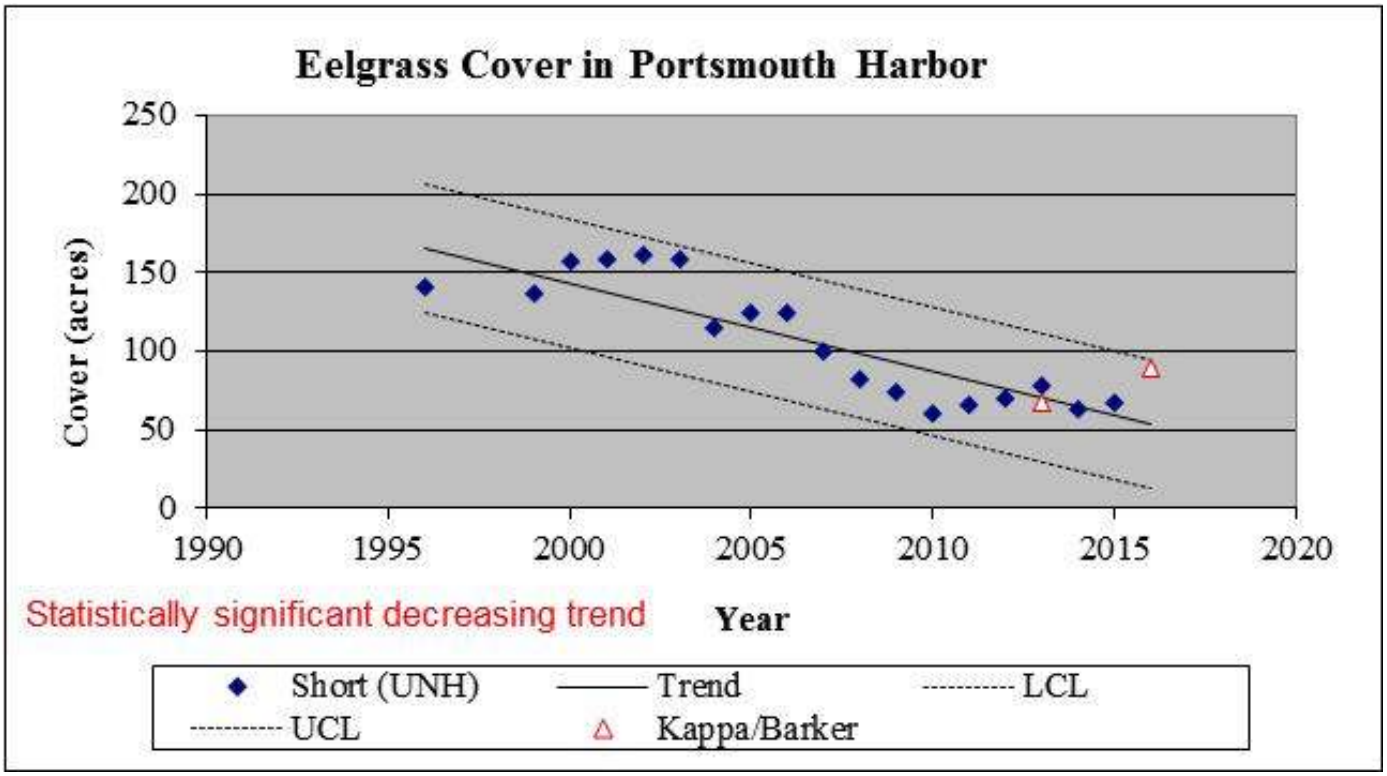
Indicator	Aquatic Life Use Category 2014 / 2016	2016 Comment
Chlorophyll-a	2-G / 2-G	The calculated 90th percentile chlorophyll-a in this assessment zone is 3.2 ug/L (n = 43) and a maximum reading of 5.7 ug/L. The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L.
Dissolved Oxygen (mg/L)	2-M / 2-G	This assessment zone has datalogger and grab measurements for dissolved oxygen concentration covering 2011 through 2015. No samples fell below 5 mg/L. The available data indicates that this assessment zone meets the dissolved oxygen concentration criteria.
Dissolved Oxygen (% Saturation)	2-M / 2-G	This assessment zone has 24 hour average datalogger and grab measurements for dissolved oxygen percent saturation covering 2011 through 2015. Only one 24 hour average appears to fall below 75 percent saturation. The available data indicates that this assessment zone meets the dissolved oxygen percent saturation criteria.
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 227.7 acres from the 1948, 1962, 1980, and 1981 datasets. The median current extent of eelgrass in 2014-2016 is 65.4 acres, which is a decrease of 60.1%. Since 1990, the trend in eelgrass cover in this assessment zone is a loss of 40.4%. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	5-M / 5-M	Median=0.593 m^-1 (n=40). For an eelgrass restoration depth of 3 m, the light attenuation coefficient threshold is 0.5 m^-1. This assessment zone historically had eelgrass growing in both the shallows and deeper habitat making the 3m restoration depth a valid target. Further, a review of the location of the deep edge of the eelgrass suggests that the maximum depth of eelgrass survival is not as deep as it was in the past. Due to the proximity of the Portsmouth WWTF, this assessment zone may be experiencing a large portion of light diminishment from the large TSS load out of the discharge. Therefore, the impaired (5-M) listing from the 2014 303d list has been retained.
Total Nitrogen	3-PNS / 2-M	The median total nitrogen from 2011 through 2015 was 228 ug/L (n=44). In the continuous data (2011-2015) the dissolved oxygen concentration was always met and there was a single day where the percent saturation criteria were not met. The chlorophyll-a data indicates that this assessment zone meets the chlorophyll-a indicator to protect dissolved oxygen. The eelgrass beds are severely degraded. The available light attenuation data (median=0.593 m^-1 (n=40)) appears inadequate for the 3 m restoration depth but may be reflective the Total Suspended Solids (TSS) load from the Portsmouth WWTF. For shallow systems, it is expected that changes in macroalgae will precede changes in phytoplankton (McGlathery, Sundbäck, & Anderson, 2007) (Valiela, et al., 1997). No direct sampling efforts have taken place to evaluate the extent of epiphytes and macrophytes however regarding macroalgae, Burdick et al. (Burdick, Mathieson, Peter, & Sydney, 2016)stated, “Monitoring results from 2014 show high levels of cover of nuisance green and red algae (*Ulva* and *Gracilaria*, respectively) at all sites except near the mouth of the Estuary.” The “mouth of the estuary site” is Four Tree Island, approximately 1 mile upstream from the Portsmouth Harbor assessment zone. While the five year median total nitrogen is remains slightly above the estimated offshore total nitrogen concentration of 200 ug/L, the data suggest that Portsmouth Harbor total nitrogen is decreasing with essentially offshore -like conditions in 2015. At this time there are few of the classic indicators of nutrient eutrophication present in this assessment zone. There is insufficient power in the response datasets to determine that eutrophication by total nitrogen is alone is not known to be strong enough to warrant impairment under New Hampshire’s narrative standard. As such, this assessment zone has been assessed as marginally fully supporting (2-M) for total nitrogen.

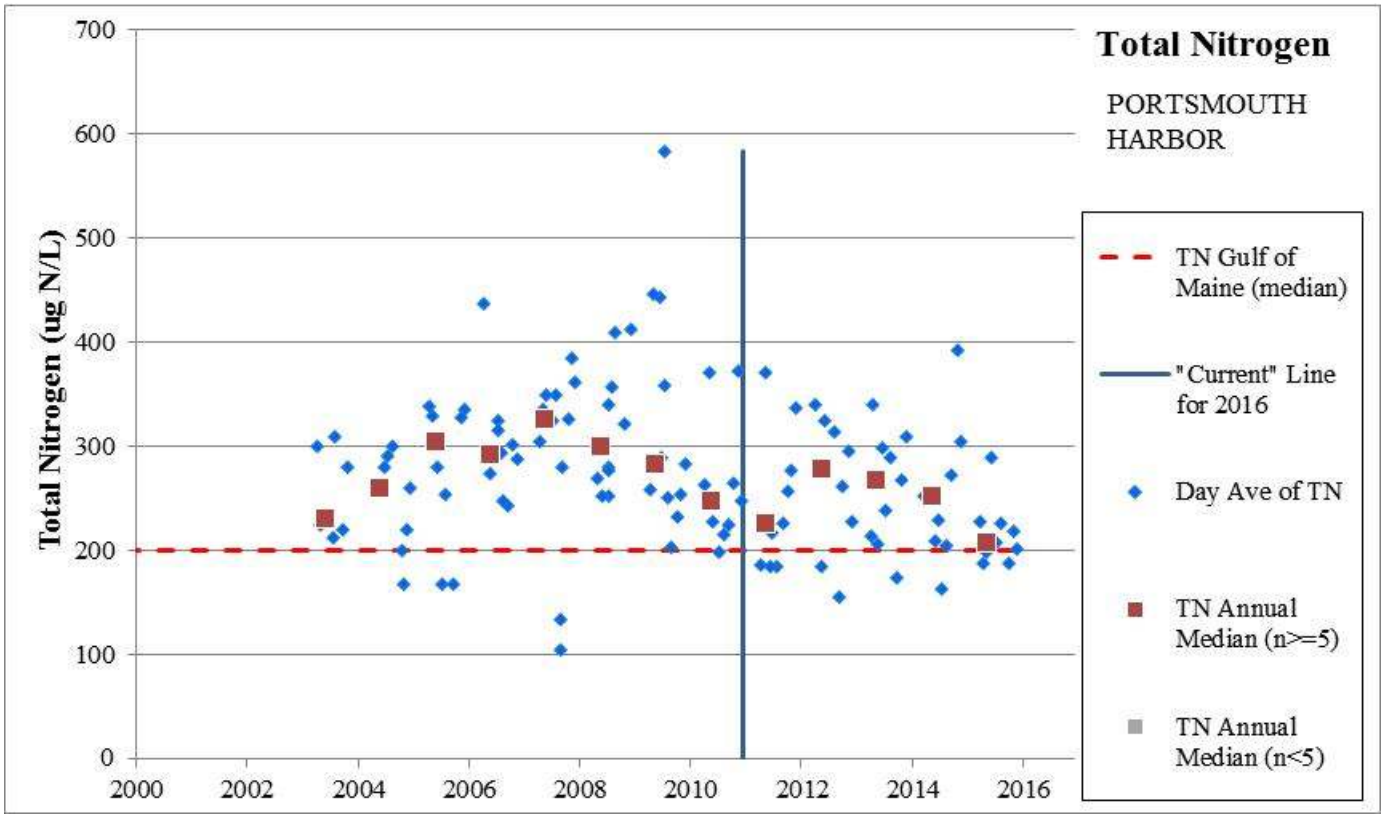

Chlorophyll-a
PORTSMOUTH HARBOR
ug Chl-a / L
0
2
4
6
8
10
12
2000
2002
2004
2006
2008
2010
2012
2014
2016
Chl-a Ind. (90th percentile)
"Current" Line for 2016
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN


Dissolved Oxygen Concentration
PORTSMOUTH HARBOR
Dissolved Oxygen, mg / L
0
2
4
6
8
10
12
14
16
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2016
DO-PPM-GRAB-NCP
DO-PPM-24HR-MIN-NCP
DO-PPM-GRAB-CP
DO-PPM-24HR-MIN-CP


Dissolved Oxygen Percent Saturation
PORTSMOUTH HARBOR
Dissolved Oxygen, Percent Saturation
140
120
100
80
60
40
20
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2016
DO-PERC-2TIDE-GRAB-NCP
DO-PERC-2TIDE-GRAB-CP
DO-PERC-24H-MEAN-NCP
DO-PERC-24H-MEAN-CP


Light Attenuation
PORTSMOUTH HARBOR
Kd 1 / m (PAR) (lower is better)
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
Min. for Survival Indicator (median)
"Current" Line for 2016
Light Attenuation Coefficient


Eelgrass Cover in Portsmouth Harbor
Cover (acres)
250
200
150
100
50
0
1990
1995
2000
2005
2010
2015
2020
Year
Statistically significant decreasing trend
Short (UNH)
Trend
LCL
UCL
Kappa/Barker

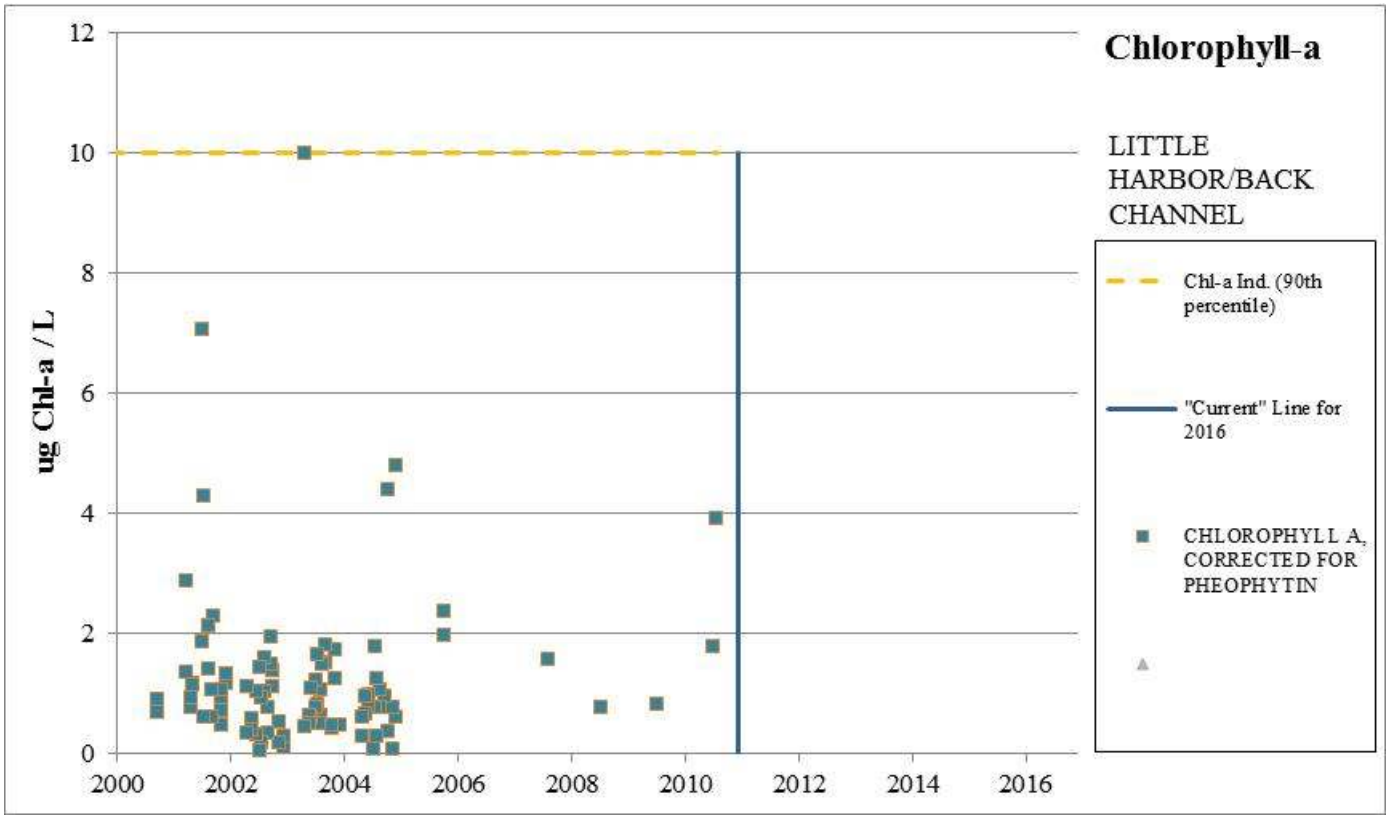

Total Nitrogen
PORTSMOUTH HARBOR
Total Nitrogen (ug N/L)
700
600
500
400
300
200
100
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
TN Gulf of Maine (median)
"Current" Line for 2016
Day Ave of TN
TN Annual Median (n>=5)
TN Annual Median (n<5)

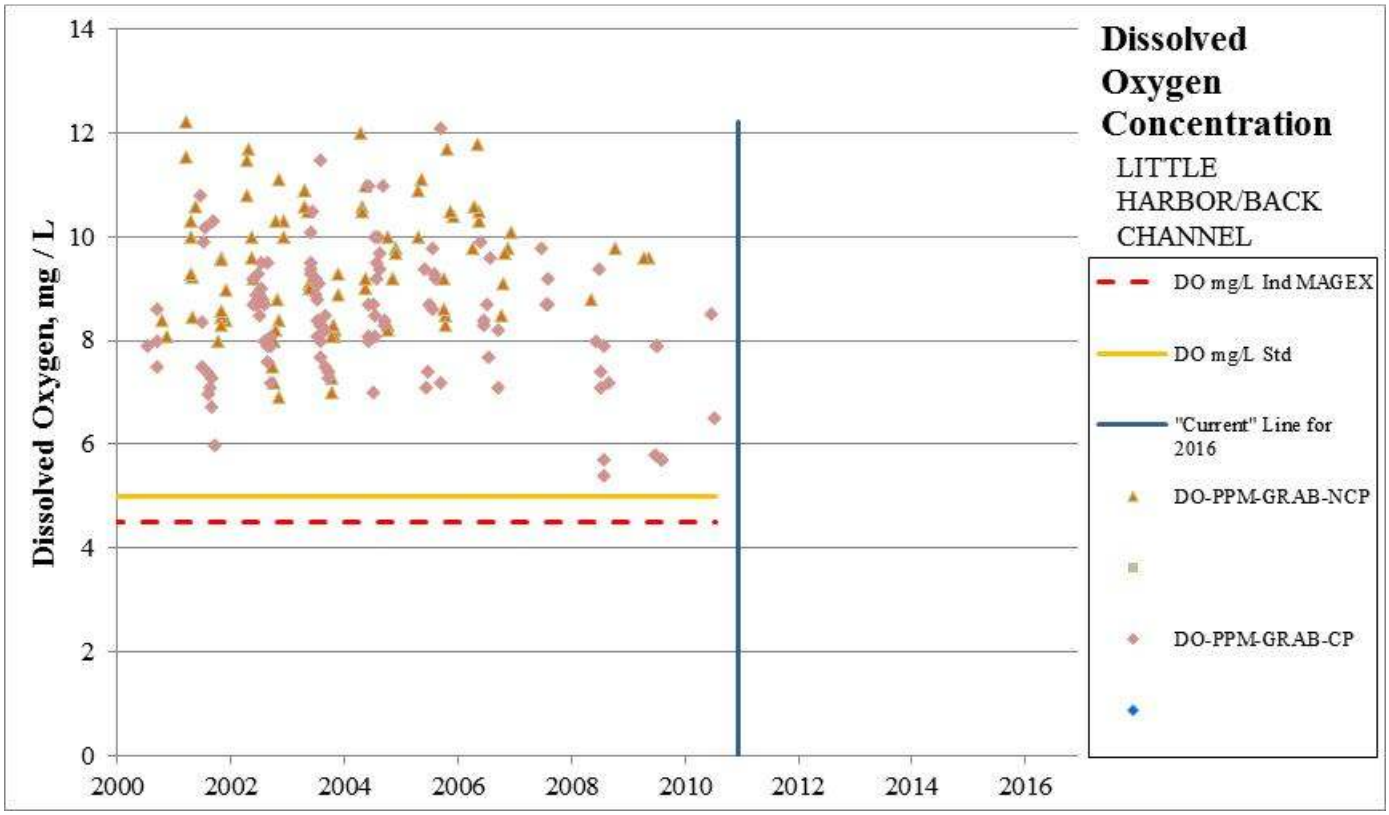
Portsmouth Harbor Assessment Zone	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	43	0.5	1.7	**3.2**	5.7
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	0	-	-	**-**	-
CHLOROPHYLL A, combined	43	0.0	1.7	3.2	5.7
DO-PERC-24H-MEAN-CP	524	82.4	97.3	105.5	122.3
DO-PERC-24H-MEAN-NCP	1,111	74.5	97.6	107.3	116.4
DO-PERC-2TIDE-GRAB-CP	0	-	-	**-**	-
DO-PERC-2TIDE-GRAB-NCP	1	95.8	95.8	-	95.8
DO-PPM-24HR-MIN-CP	516	5.1	7.1	8.0	9.3
DO-PPM-24HR-MIN-NCP	1,116	6.0	9.8	11.3	12.1
DO-PPM-GRAB-CP	0	-	-	**-**	-
DO-PPM-GRAB-NCP	1	9.5	9.5	-	9.5
LIGHT ATTENUATION COEFFICIENT	40	0.365	**0.593**	0.848	0.890
TURBIDITY	1,382	0.0	1.1	8.0	372.5
Day Ave of TN	44	156	**228**	339	393
Day Ave of TDN	45	88	168	275	325
Day Ave of DIN (NH3 + NO2/3)	45	10	80	205	230
Day Ave of NH3	45	3	29	114	181
Day Ave of PON	0	-	-	**-**	-
Day Ave of NO2/3	45	3	39	130	186

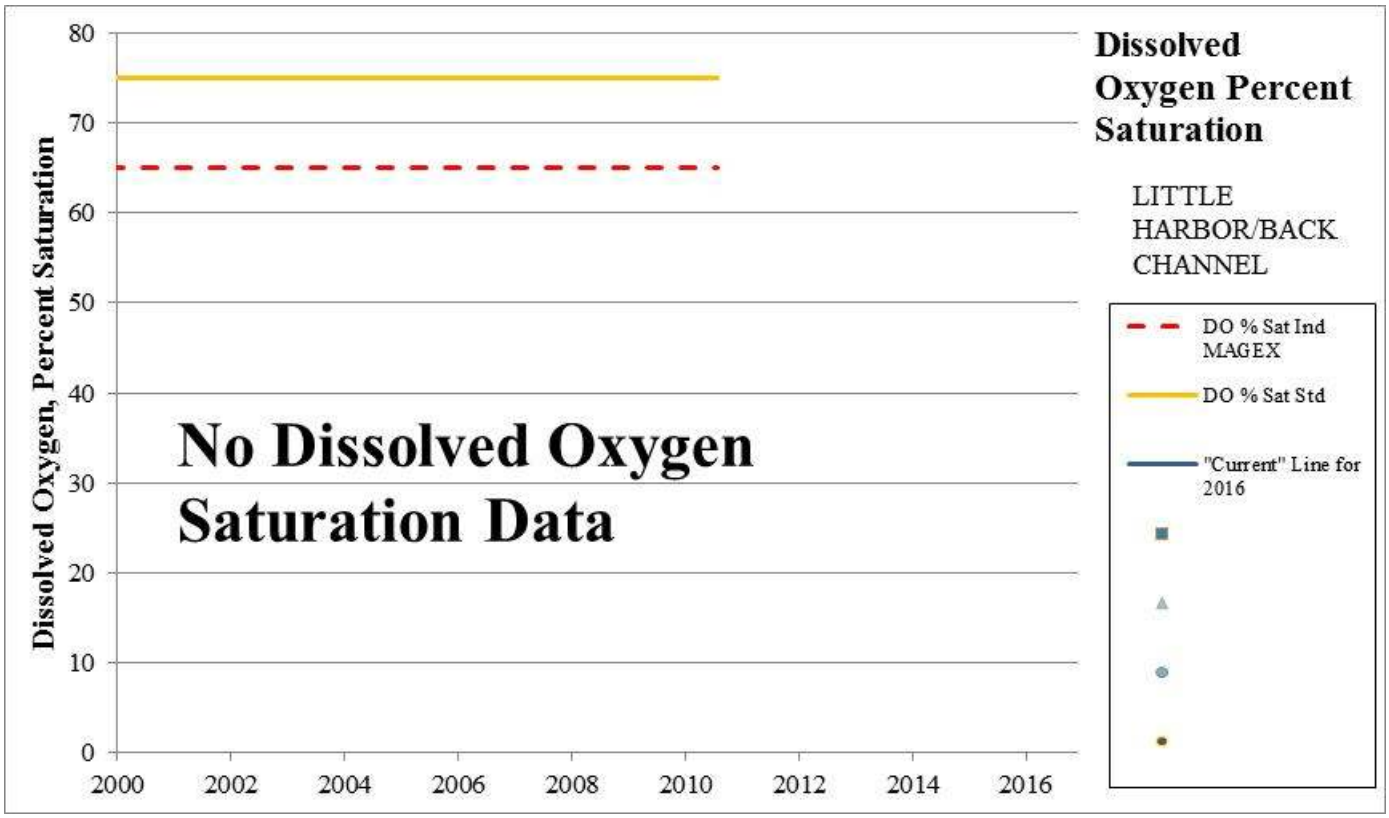
Assessment Zone = LITTLE HARBOR/BACK CHANNEL

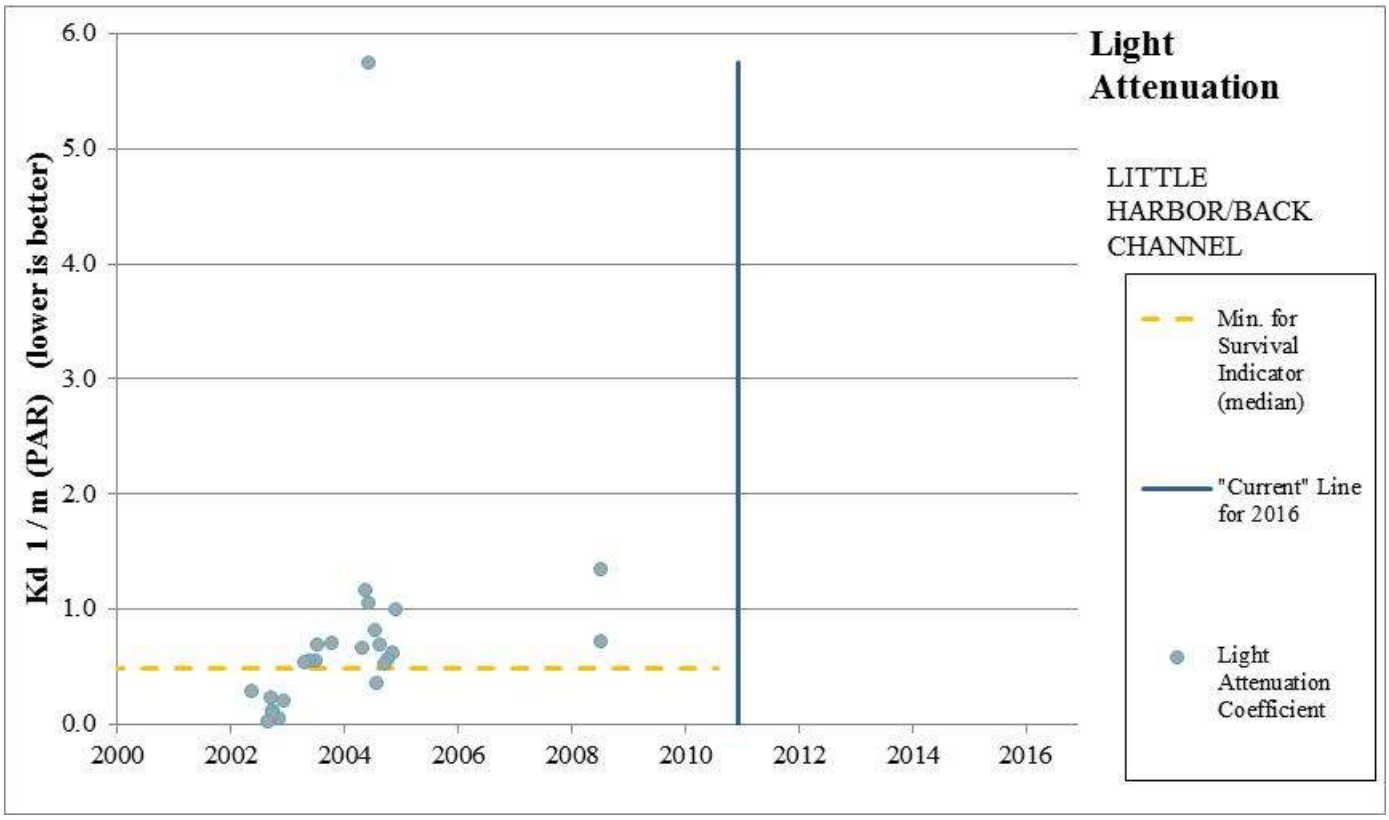
(NHEST600031001-05, NHEST600031001-08, NHEST600031002-02)

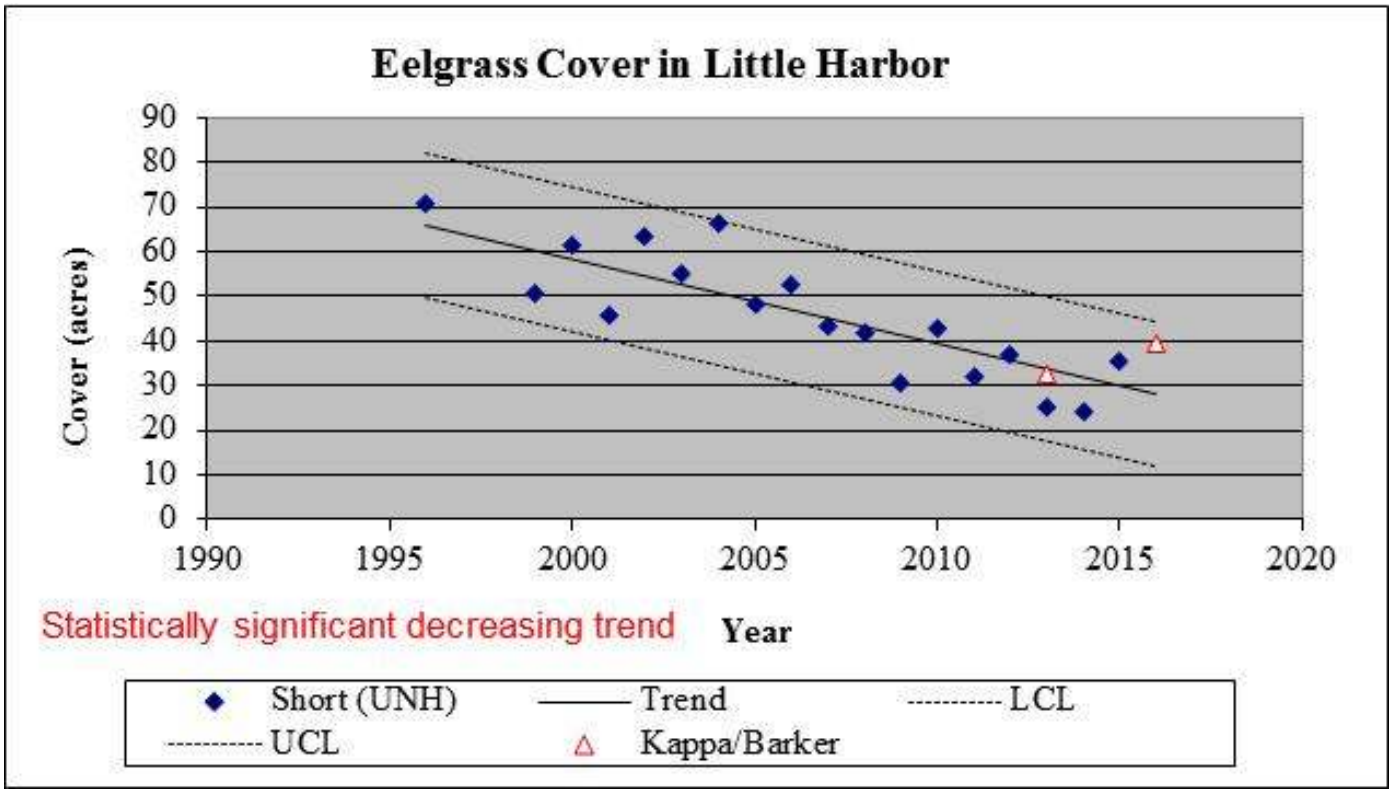
Indicator	Aquatic Life Use Category 2014 / 2016	2016 Comment
Chlorophyll-a	3-PAS / 3-ND	The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L. This assessment zone has no measurements for chlorophyll-a since 2010.
Dissolved Oxygen (mg/L)	2-G / 3-ND	This assessment zone has no measurements for dissolved oxygen concentration since 2010. As such, this assessment zone has been assessed as 3-ND (No Data) dissolved oxygen concentration.
Dissolved Oxygen (% Saturation)	3-ND / 3-ND	No Data
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 68.8 acres from the 1948, 1962, 1980, and 1981 datasets. The median current extent of eelgrass in 2014-2016 is 34.9 acres, which is a decrease of 49.1%. Since 1990, the trend in eelgrass cover in this assessment zone is a loss of 36.8%. The thresholds for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	5-M / 5-M	There have been no light measurements collected since 2010. For an eelgrass restoration depth of 3 m, the light attenuation coefficient threshold is 0.5 m^-1. This assessment zone historically had eelgrass growing in both the shallows and deeper habitat making the 3m restoration depth a valid target. This assessment zone was listed as impaired (5-M) for water clarity to protect eelgrass habitat on the 2010 303d list. At that time the Light Attenuation Coefficient median was 0.58 m^-1 (n=25). Assessment zones that were impaired in the previous cycle cannot be removed from the 303d list if there are insufficient data to make a new assessment. Therefore, the impaired (5-M) listing from the 2010 through 2014 303d lists has been retained.
Total Nitrogen	3-PNS / 3-ND	There are no "current" total nitrogen data from which to calculate a median total nitrogen from 2011 through 2015. There are no data to evaluate dissolved oxygen concentration or percent saturation, or chlorophyll-a. The eelgrass beds are less than half their historic extent. There have been no light measurements collected since 2010 to compare to the 3 m restoration depth. No direct sampling efforts have taken place to evaluate the extent of epiphytes and macrophytes however regarding macroalgae, Burdick et al. (Burdick, Mathieson, Peter, & Sydney, 2016) stated, "Monitoring results from 2014 show high levels of cover of nuisance green and red algae (*Ulva* and *Gracilaria*, respectively) at all sites except near the mouth of the Estuary." The "mouth of the estuary site" is Four Tree Island, approximately 0.5 mile upstream from the Portsmouth Harbor assessment zone. This assessment zone is generally characterized by its lack eutrophication indicator data. Overall, there is insufficient power in the response datasets to determine that eutrophication by total nitrogen is alone is not known to be strong enough to warrant impairment under New Hampshire's narrative standard. As such, this assessment zone has been assessed as 3-ND (No Data) total nitrogen.

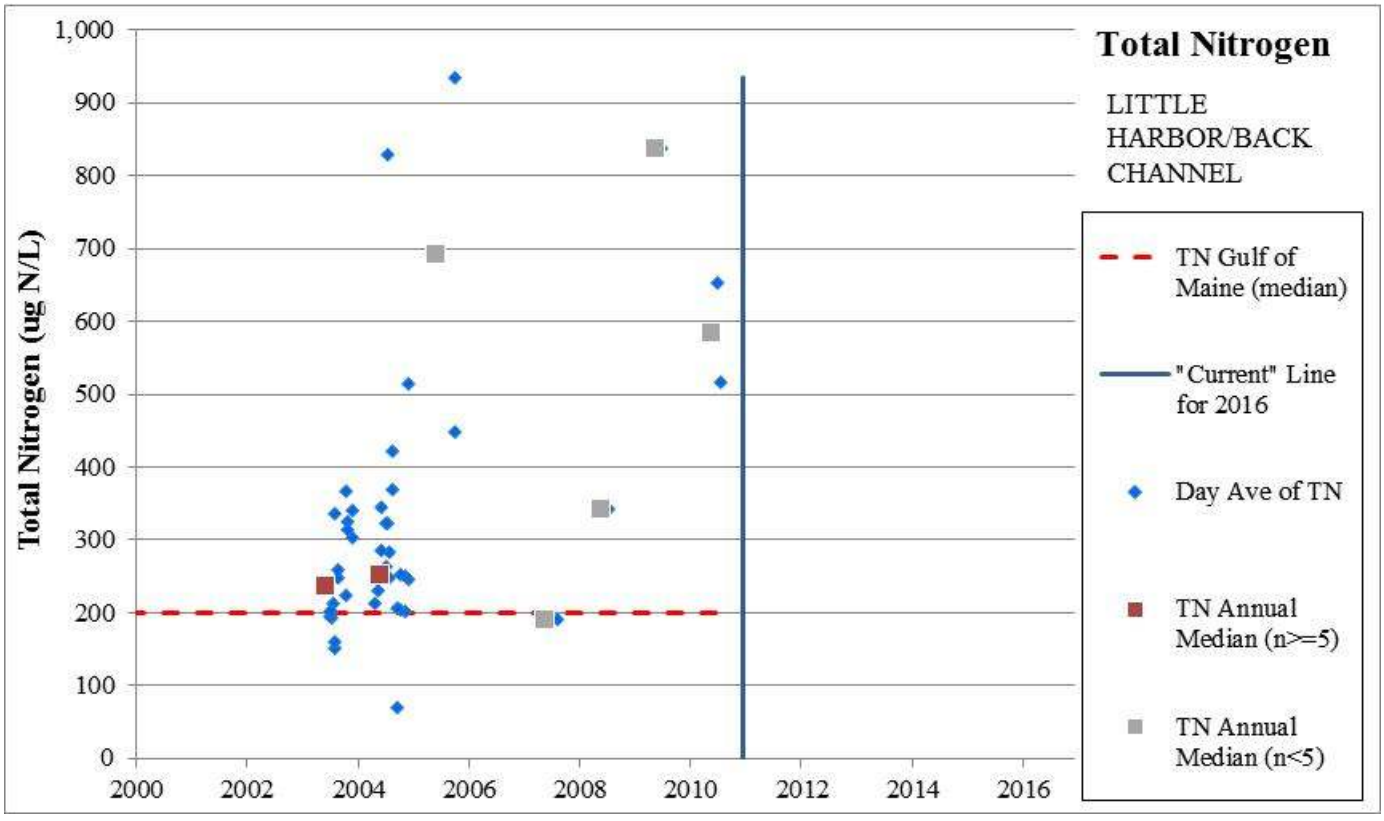

Chlorophyll-a
LITTLE HARBOR/BACK CHANNEL
ug Chl-a / L
0
2
4
6
8
10
12
2000
2002
2004
2006
2008
2010
2012
2014
2016
Chl-a Ind. (90th percentile)
"Current" Line for 2016
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN


Dissolved Oxygen Concentration
LITTLE HARBOR/BACK CHANNEL
Dissolved Oxygen, mg / L
0
2
4
6
8
10
12
14
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2016
DO-PPM-GRAB-NCP
DO-PPM-GRAB-CP


Dissolved Oxygen Percent Saturation
LITTLE HARBOR/BACK CHANNEL
Dissolved Oxygen, Percent Saturation
No Dissolved Oxygen Saturation Data
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2016
0
10
20
30
40
50
60
70
80
2000
2002
2004
2006
2008
2010
2012
2014
2016


Light Attenuation
LITTLE HARBOR/BACK CHANNEL
Kd 1 / m (PAR) (lower is better)
Min. for Survival Indicator (median)
"Current" Line for 2016
Light Attenuation Coefficient
0.0
1.0
2.0
3.0
4.0
5.0
6.0
2000
2002
2004
2006
2008
2010
2012
2014
2016


Eelgrass Cover in Little Harbor
Cover (acres)
90
80
70
60
50
40
30
20
10
0
1990
1995
2000
2005
2010
2015
2020
Statistically significant decreasing trend
Year
Short (UNH)
Trend
LCL
UCL
Kappa/Barker

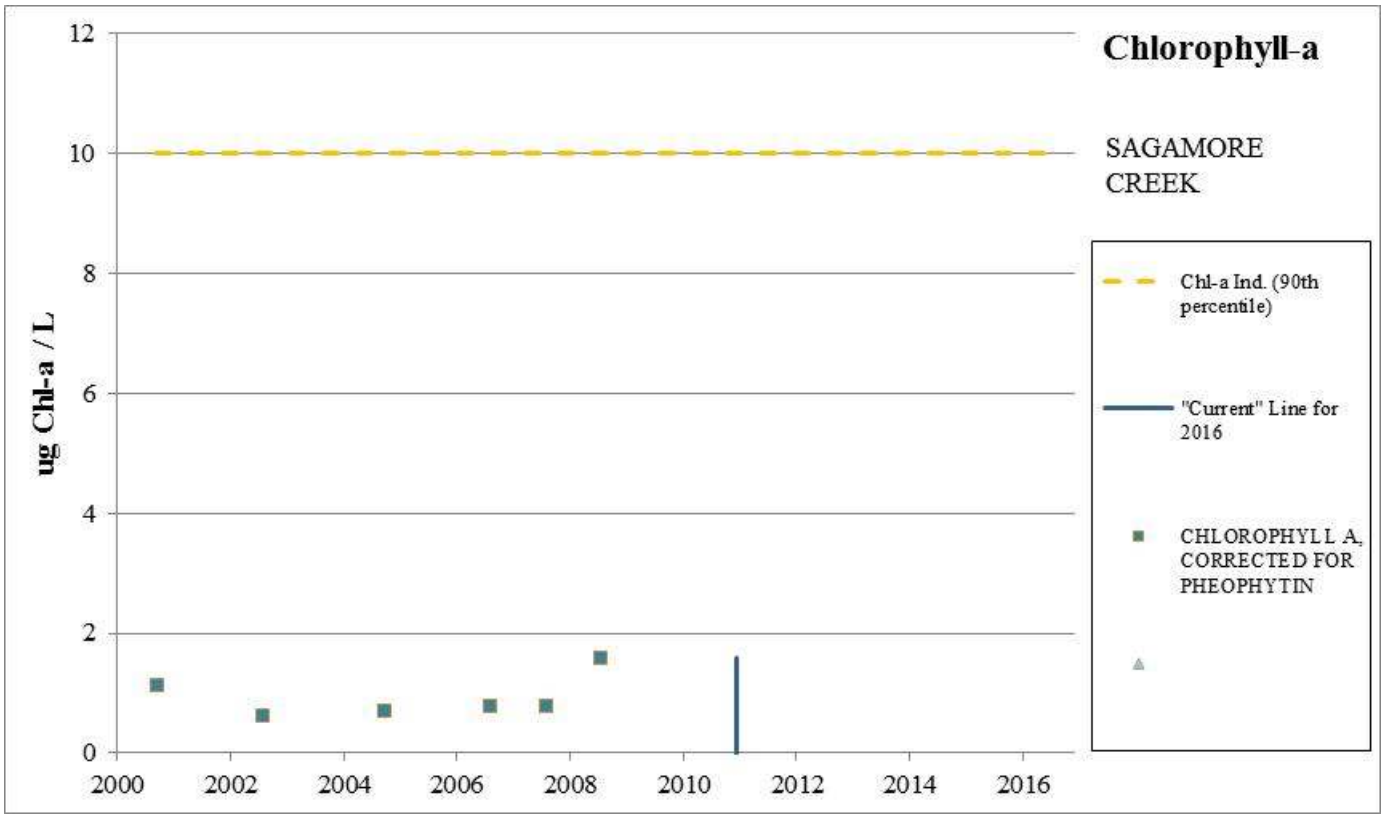

Total Nitrogen
LITTLE HARBOR/BACK CHANNEL
Total Nitrogen (ug N/L)
1,000
900
800
700
600
500
400
300
200
100
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
TN Gulf of Maine (median)
"Current" Line for 2016
Day Ave of TN
TN Annual Median (n>=5)
TN Annual Median (n<5)

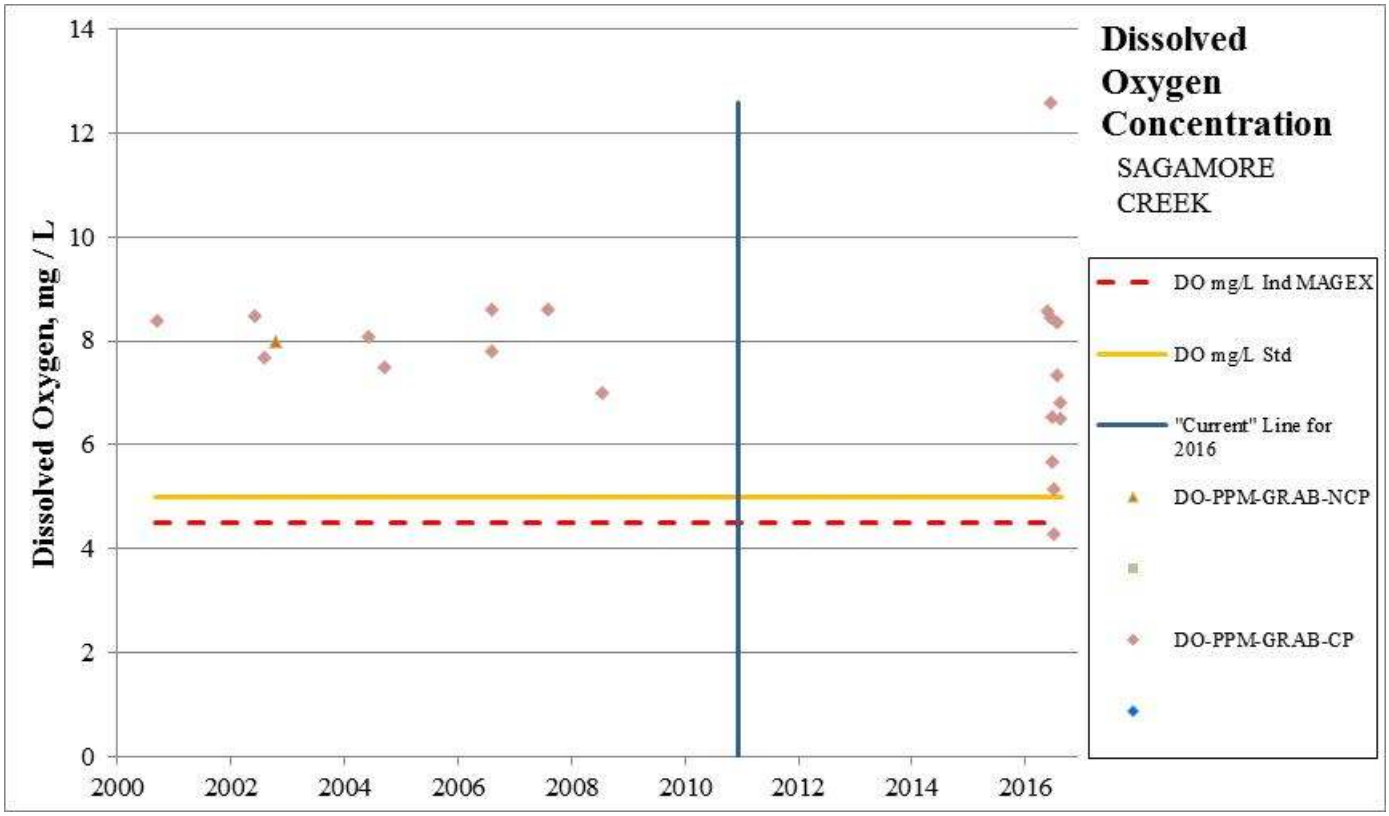
Little Harbor / Back Channel Assessment Zone	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	0	-	-	-	-
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	0	-	-	-	-
CHLOROPHYLL A, combined	0	-	-	-	-
DO-PERC-24H-MEAN-CP	0	-	-	-	-
DO-PERC-24H-MEAN-NCP	0	-	-	-	-
DO-PERC-2TIDE-GRAB-CP	0	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP	0	-	-	-	-
DO-PPM-24HR-MIN-CP	0	-	-	-	-
DO-PPM-24HR-MIN-NCP	0	-	-	-	-
DO-PPM-GRAB-CP	0	-	-	-	-
DO-PPM-GRAB-NCP	0	-	-	-	-
LIGHT ATTENUATION COEFFICIENT	0	-	-	-	-
TURBIDITY	0	-	-	-	-
Day Ave of TN	0	-	-	-	-
Day Ave of TDN	0	-	-	-	-
Day Ave of DIN (NH3 + NO2/3)	0	-	-	-	-
Day Ave of NH3	0	-	-	-	-
Day Ave of PON	0	-	-	-	-
Day Ave of NO2/3	0	-	-	-	-

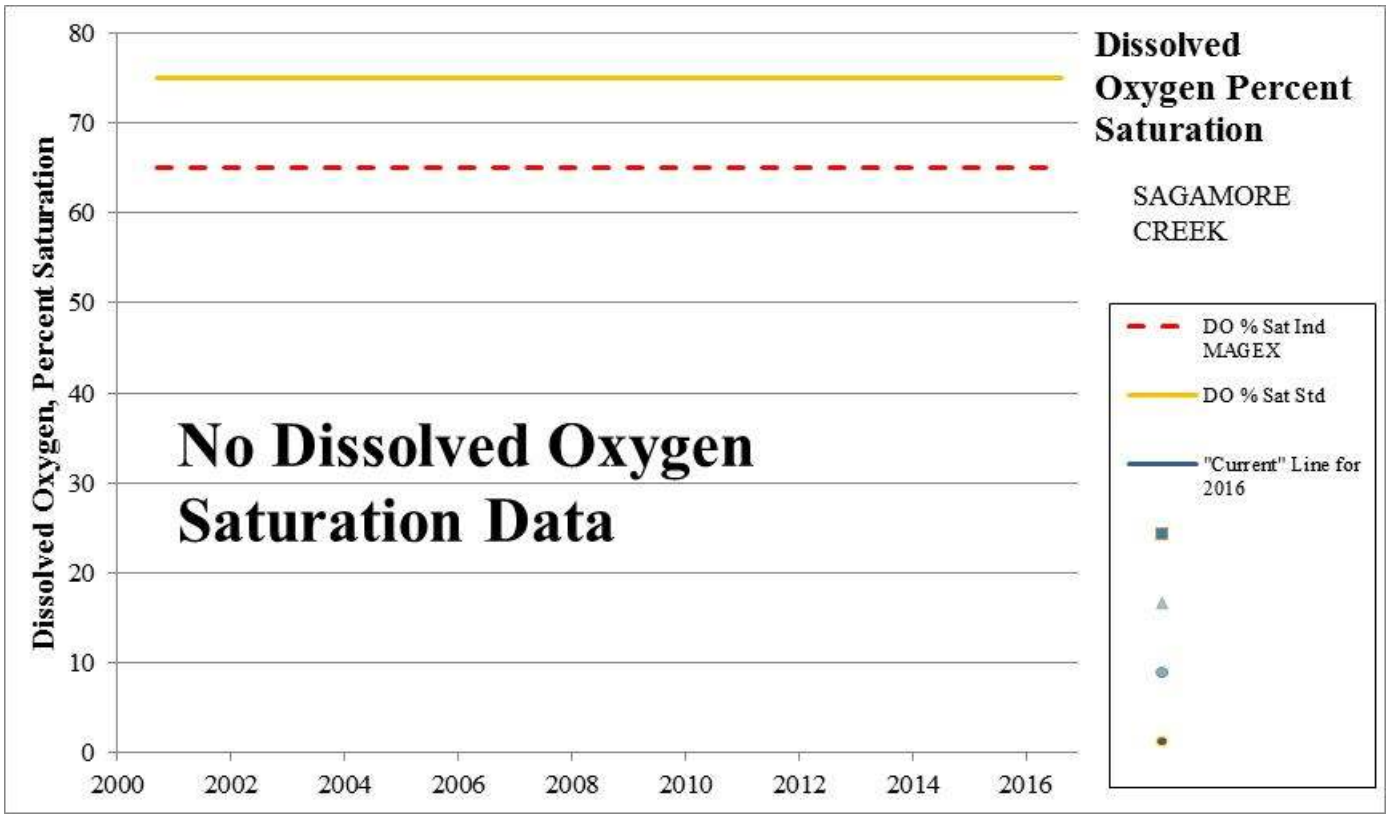
Assessment Zone = SAGAMORE CREEK

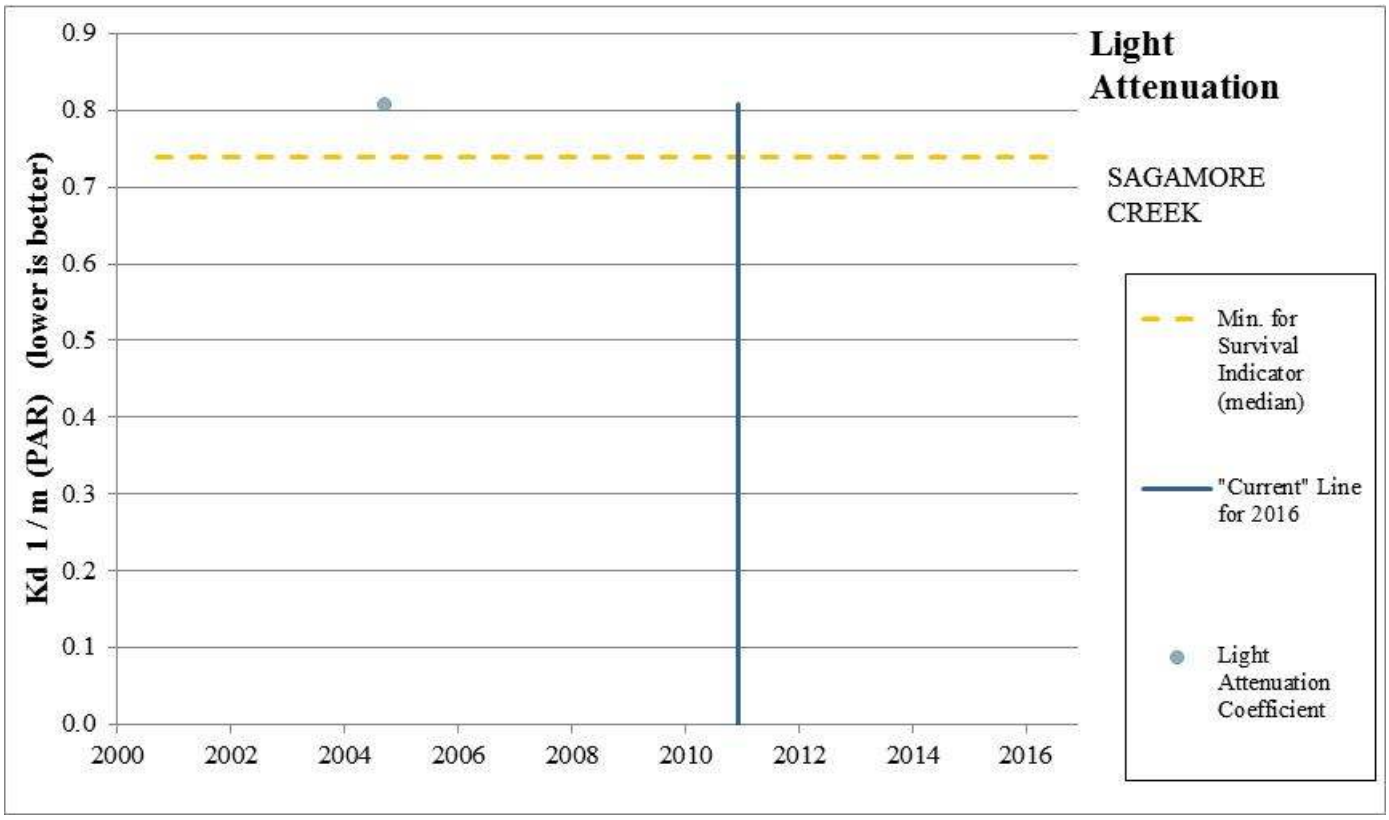
(NHEST600031001-03, NHEST600031001-04)

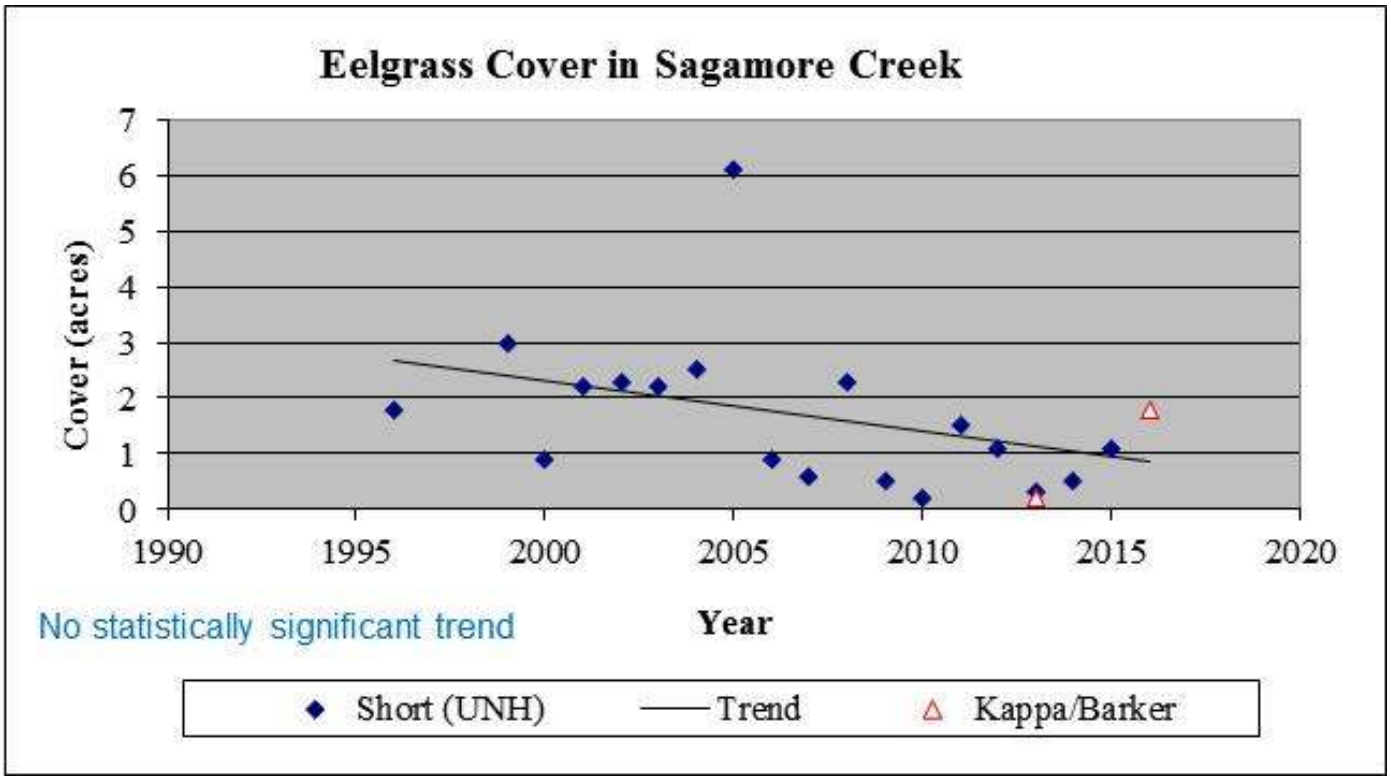
Indicator	Aquatic Life Use Category 2014 / 2016	2016 Comment
Chlorophyll-a	3-PAS / 3-ND	The calculated 90th percentile chlorophyll-a in this assessment zone cannot be calculated due to the presence of only one measured value since 2008 (1.6 ug/L). The chlorophyll-a indicator threshold to prevent low dissolved oxygen is a 90th percentile below 10 ug/L.
Dissolved Oxygen (mg/L)	3-PAS / 2-M	This assessment zone had 11 surface grab sample measurements collected in 2016 for dissolved oxygen concentration That available data indicates that this assessment zone meets the dissolved oxygen concentration criteria.
Dissolved Oxygen (% Saturation)	3-ND / 3-ND	No Data
Estuarine Bioassessments (eelgrass)	5-P / 5-P	The historical extent of eelgrass in this assessment zone was 4.1 acres from the 1948, 1962, 1980, and 1981 datasets. The median current extent of eelgrass in 2014-2016 is 1.1 acres, which is a decrease of 74.2%. Since 1990, the trend in eelgrass cover in this assessment zone was not significant. The threshold for impairment are either loss of more than 20% of the historic extent of eelgrass or a recent trend of greater than 20% loss.
Water Clarity (Light Attenuation Coefficient)	3-ND / 3-ND	There have been no light measurements collected since 2005.This assessment zone historically had eelgrass growing in both the shallows and deeper habitat making the 3m restoration depth a valid target. Further, a review of the location of the deep edge of the eelgrass suggests that the maximum depth of eelgrass survival is not as deep as it was in the past. As there is no measured light attenuation, this zone remains assessed as “no data”.
Total Nitrogen	3-ND / 3-ND	There are no “current” total nitrogen data from which to calculate a median total nitrogen from 2011 through 2015. The available dissolved oxygen concentration data generally meets water quality standards and there is no dissolved oxygen percent saturation or light attenuation data in the current period. There is no current chlorophyll-a data. The eelgrass beds are severely degraded. There are insufficient data to indicate that the eutrophication is strong enough to warrant impairment. As such, this assessment zone has been assessed as no data for total nitrogen.

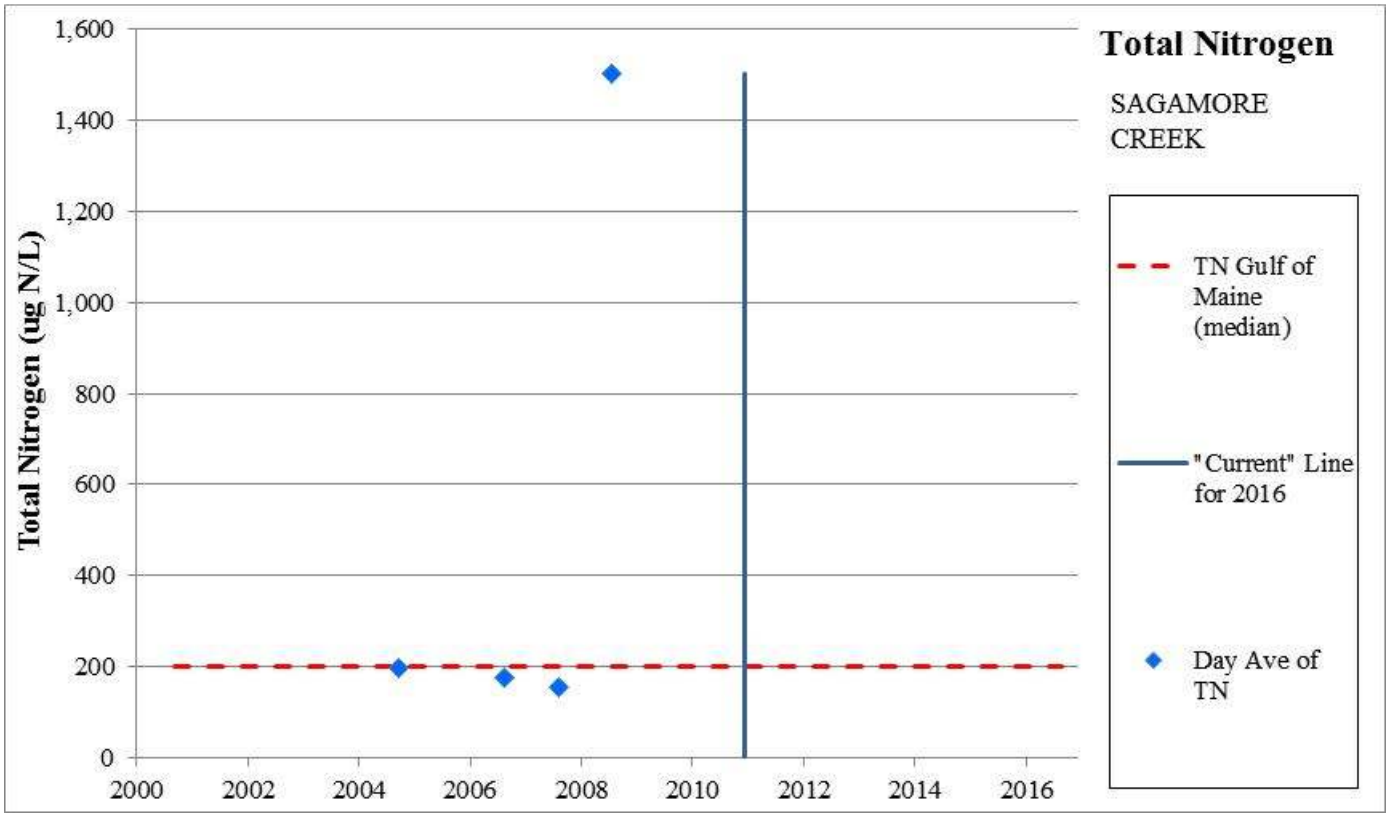

Chlorophyll-a
SAGAMORE CREEK
ug Chl-a / L
12
10
8
6
4
2
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
Chl-a Ind. (90th percentile)
"Current" Line for 2016
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN


Dissolved Oxygen Concentration
SAGAMORE CREEK
Dissolved Oxygen, mg / L
14
12
10
8
6
4
2
0
2000
2002
2004
2006
2008
2010
2012
2014
2016
DO mg/L Ind MAGEX
DO mg/L Std
"Current" Line for 2016
DO-PPM-GRAB-NCP
DO-PPM-GRAB-CP


Dissolved Oxygen Percent Saturation
SAGAMORE CREEK
Dissolved Oxygen, Percent Saturation
No Dissolved Oxygen Saturation Data
DO % Sat Ind MAGEX
DO % Sat Std
"Current" Line for 2016
80
70
60
50
40
30
20
10
0
2000
2002
2004
2006
2008
2010
2012
2014
2016


Light Attenuation
SAGAMORE CREEK
Kd 1 / m (PAR) (lower is better)
Min. for Survival Indicator (median)
"Current" Line for 2016
Light Attenuation Coefficient
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2000
2002
2004
2006
2008
2010
2012
2014
2016


Eelgrass Cover in Sagamore Creek
Cover (acres)
0
1
2
3
4
5
6
7
1990
1995
2000
2005
2010
2015
2020
Year
No statistically significant trend
Short (UNH)
Trend
Kappa/Barker


Total Nitrogen
SAGAMORE CREEK
Total Nitrogen (ug N/L)
0
200
400
600
800
1,000
1,200
1,400
1,600
2000
2002
2004
2006
2008
2010
2012
2014
2016
TN Gulf of Maine (median)
"Current" Line for 2016
Day Ave of TN

Sagamore Creek Assessment Zone	**Count**	**Minimum**	**Median**	**90th Percentile**	**Maximum**
CHLOROPHYLL A, CORRECTED FOR PHEOPHYTIN	0	-	-	-	-
CHLOROPHYLL A, UNCORRECTED FOR PHEOPHYTIN	0	-	-	-	-
CHLOROPHYLL A, combined	0	-	-	-	-
DO-PERC-24H-MEAN-CP	0	-	-	-	-
DO-PERC-24H-MEAN-NCP	0	-	-	-	-
DO-PERC-2TIDE-GRAB-CP	0	-	-	-	-
DO-PERC-2TIDE-GRAB-NCP	0	-	-	-	-
DO-PPM-24HR-MIN-CP	0	-	-	-	-
DO-PPM-24HR-MIN-NCP	0	-	-	-	-
DO-PPM-GRAB-CP	11	4.3	6.8	11.8	12.6
DO-PPM-GRAB-NCP	0	-	-	-	-
LIGHT ATTENUATION COEFFICIENT	0	-	-	-	-
TURBIDITY	10	1.7	4.6	8.5	8.5
Day Ave of TN	0	-	-	-	-
Day Ave of TDN	0	-	-	-	-
Day Ave of DIN (NH3 + NO2/3)	0	-	-	-	-
Day Ave of NH3	0	-	-	-	-
Day Ave of PON	0	-	-	-	-
Day Ave of NO2/3	4	150	190	-	300

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